34. The Marine Fauna of British East Africa and Zanzibar, from Collections made by Cyril Crossland, M.A., B.Sc., F.Z.S., in the Years 1901–1902. Bryozoa *—Cheilostomata. By Arthur Wm. Waters, F.L.S., F.G.S.†

[Received March 13, 1913: Read April 22, 1913.]

(Plates LXIV.–LXXIII.‡ and Text-figures 79–82.)

Index.

The collection made by Mr. Cyril Crossland in the neighbourhood of Zanzibar contains 76 species or varieties of Cheilostomata, and all are from shallow water, in fact with the exception of two are from 10 fathoms or under; so that, for a purely shallow-water collection, it is a very large one.

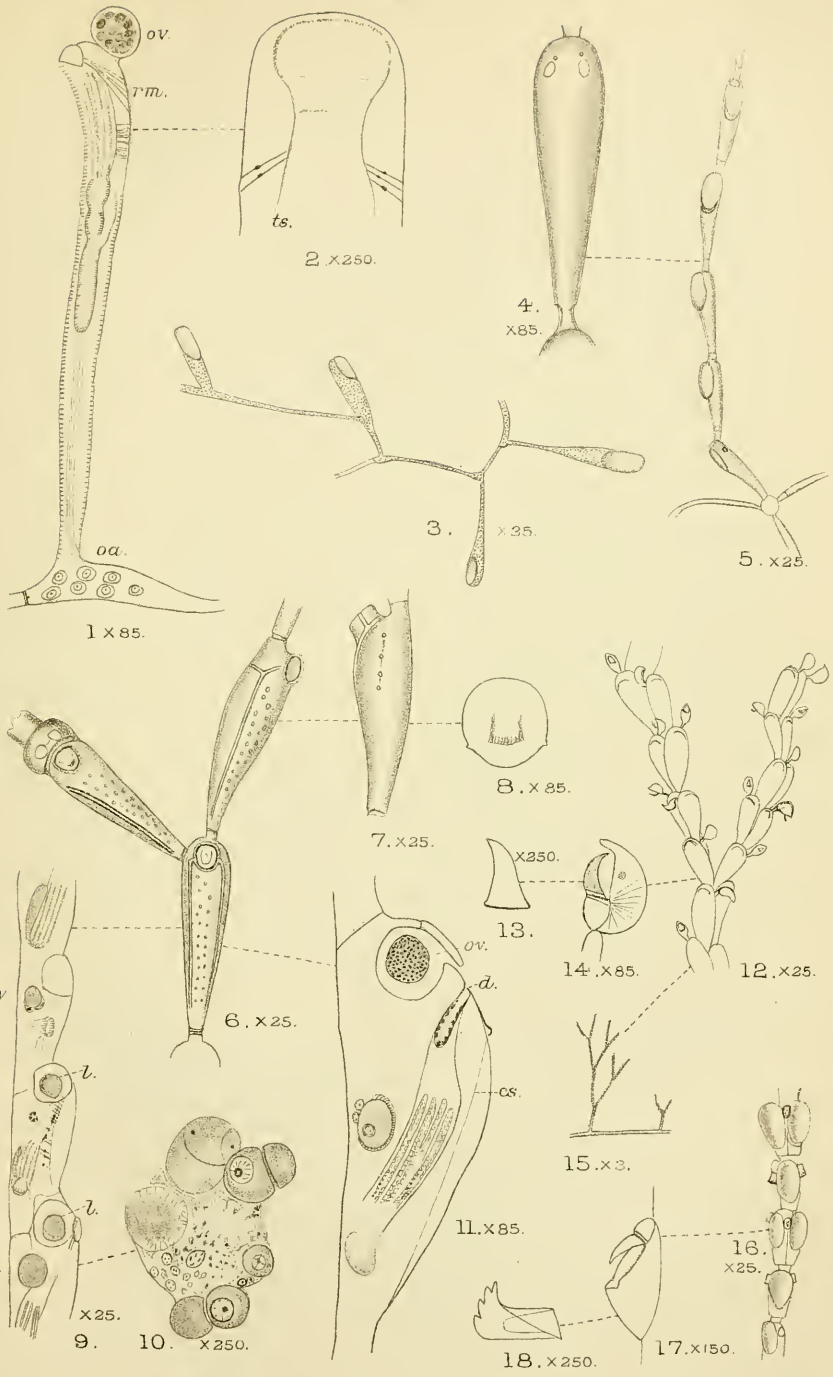
Points of Special Interest.

(1) In *Stirparia* the first zoœcium of a tuft has the character of a primary zoœcium (p. 470).

* [In view of the difference of opinion as to whether this Phylum should be called Bryozoa or Polyzoa (see Proc. Linn. Soc. 1911, p. 61) I have not interfered with the preference of the author.—Editor.]

† Communicated by Cyril Crossland, M.A., B.Sc., F.Z.S.

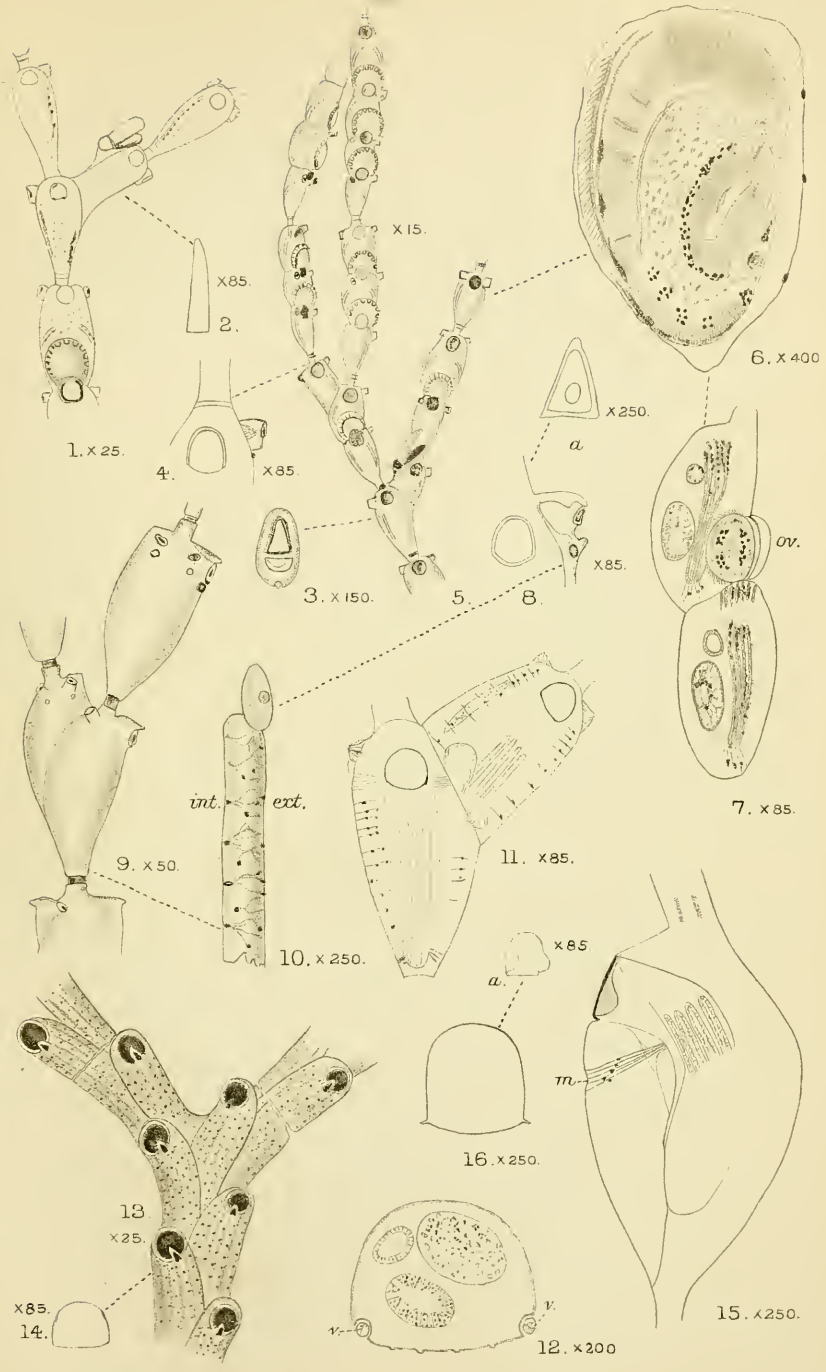
‡ For explanation of the Plates, see p. 532.



A.W. Waters del.

Huth sc. et imp.

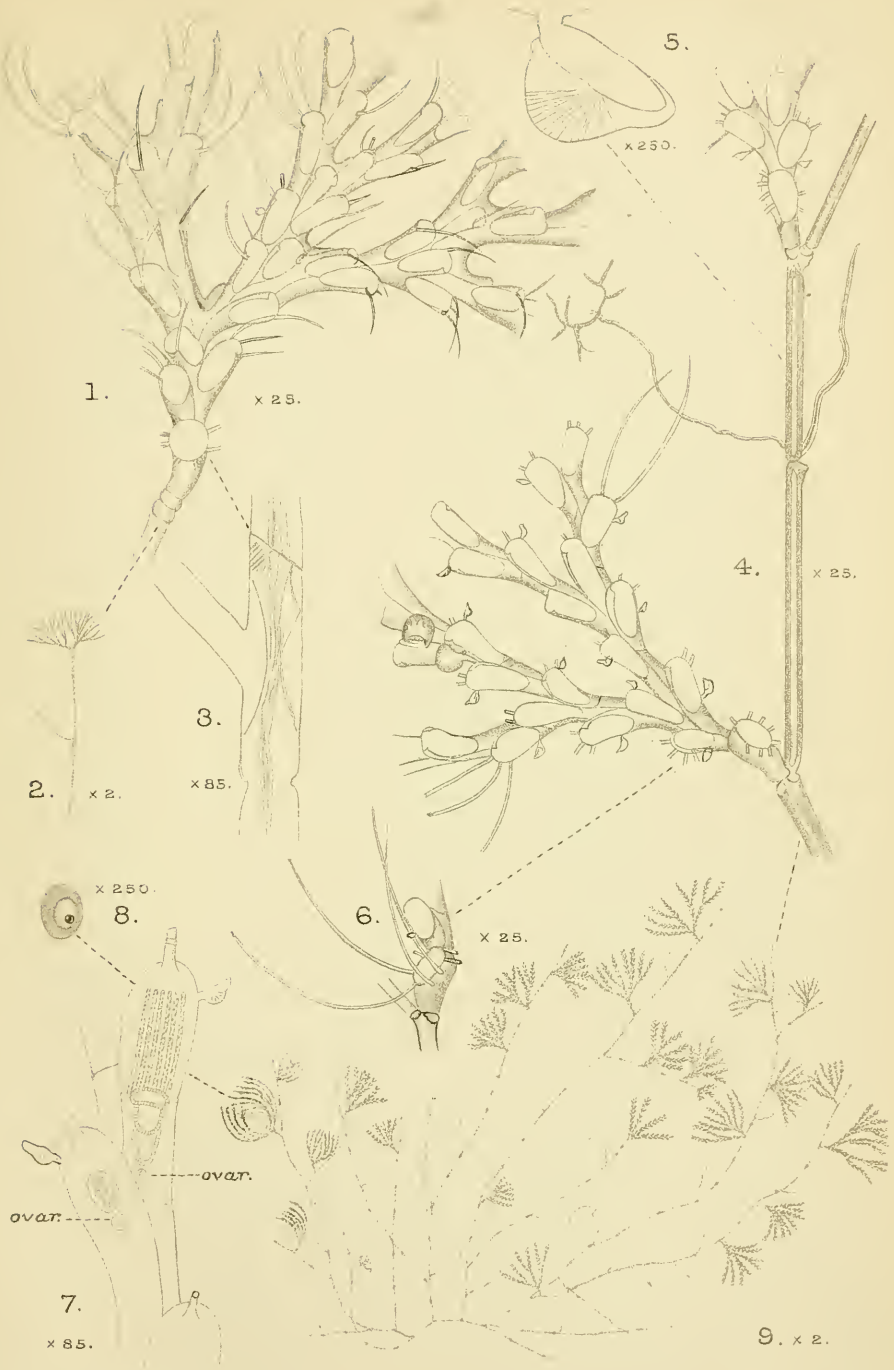
BRYOZOA FROM ZANZIBAR.



A.W.Waters del.

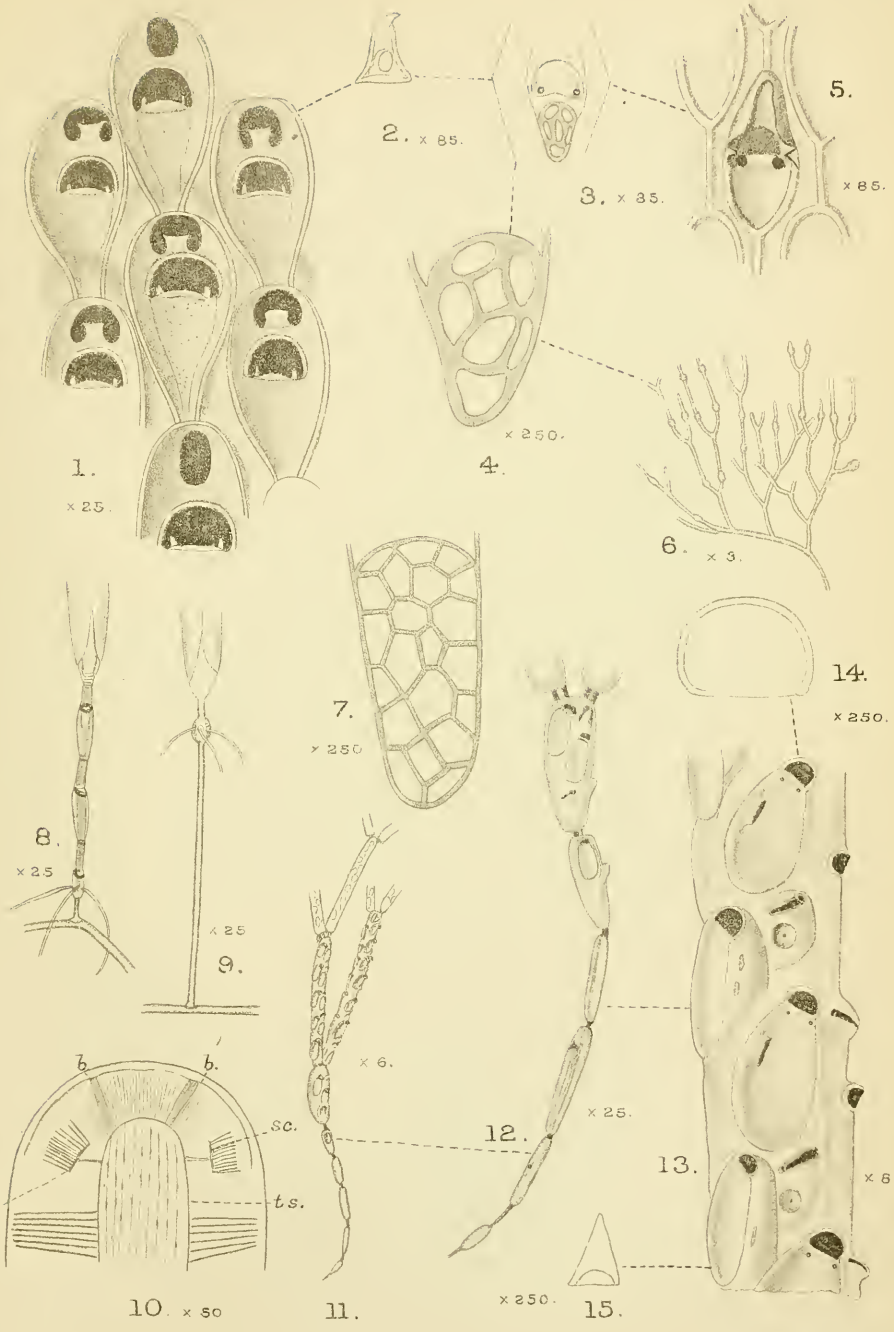
Huth sc.et imp.

BRYOZOA FROM ZANZIBAR.



A. W. Waters, del. Huth sc. et imp.

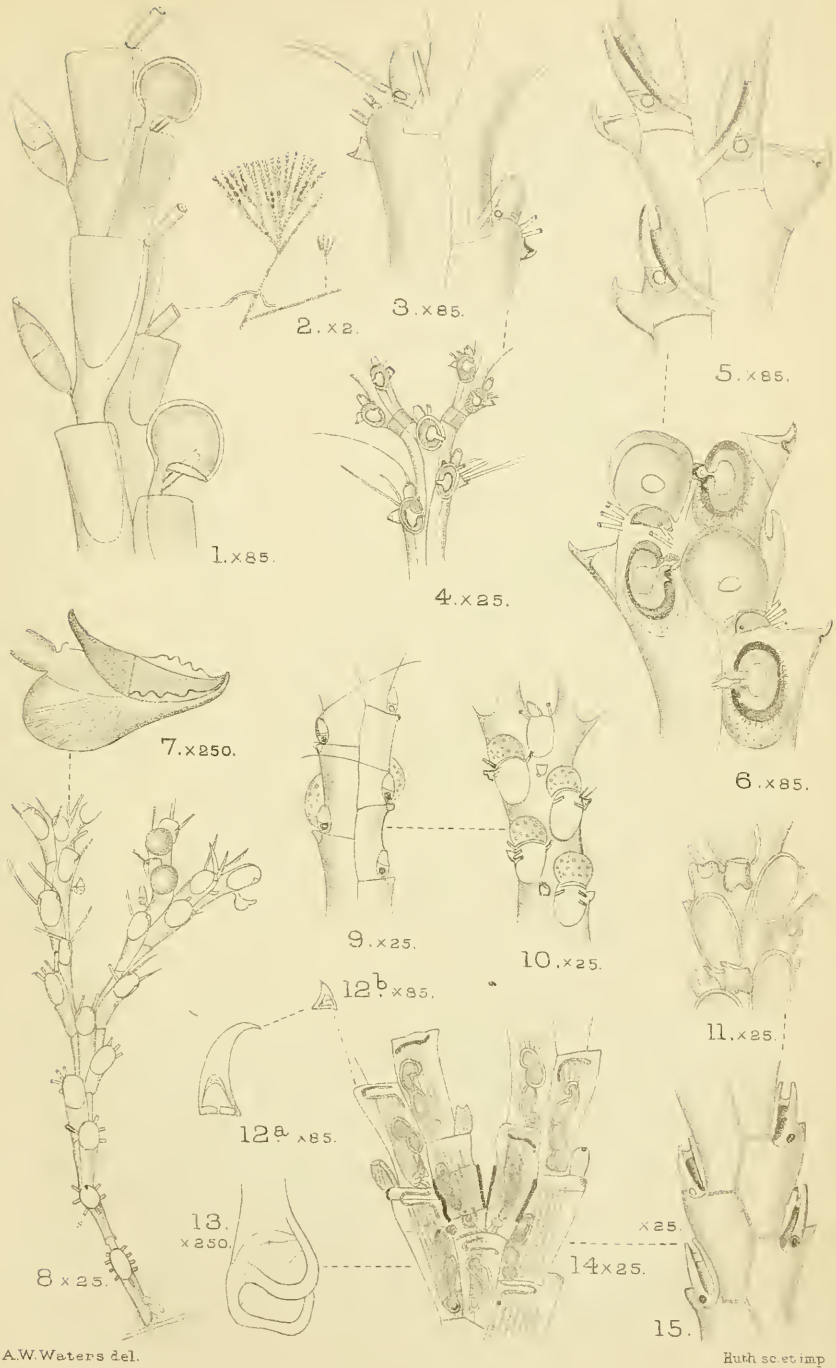
BRYOZOA FROM ZANZIBAR.



A. W. Waters, del.

Huth sc. et imp.

BRYOZOA FROM ZANZIBAR.



BRYOZOA FROM ZANZIBAR.

1. x25.

2. x25.

3. x25.

4. x25.

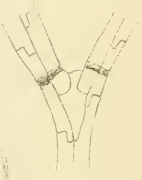
5.

6. x6.

7. x6.

8. x6.

9. x6.



10. x12.

11. x12.

12. x25.

13. x25.

14. x12.

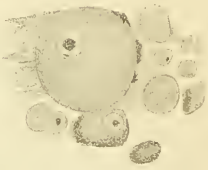
a. nat. size.

15. x25.

16. x85.

17. x85.

18. x250.



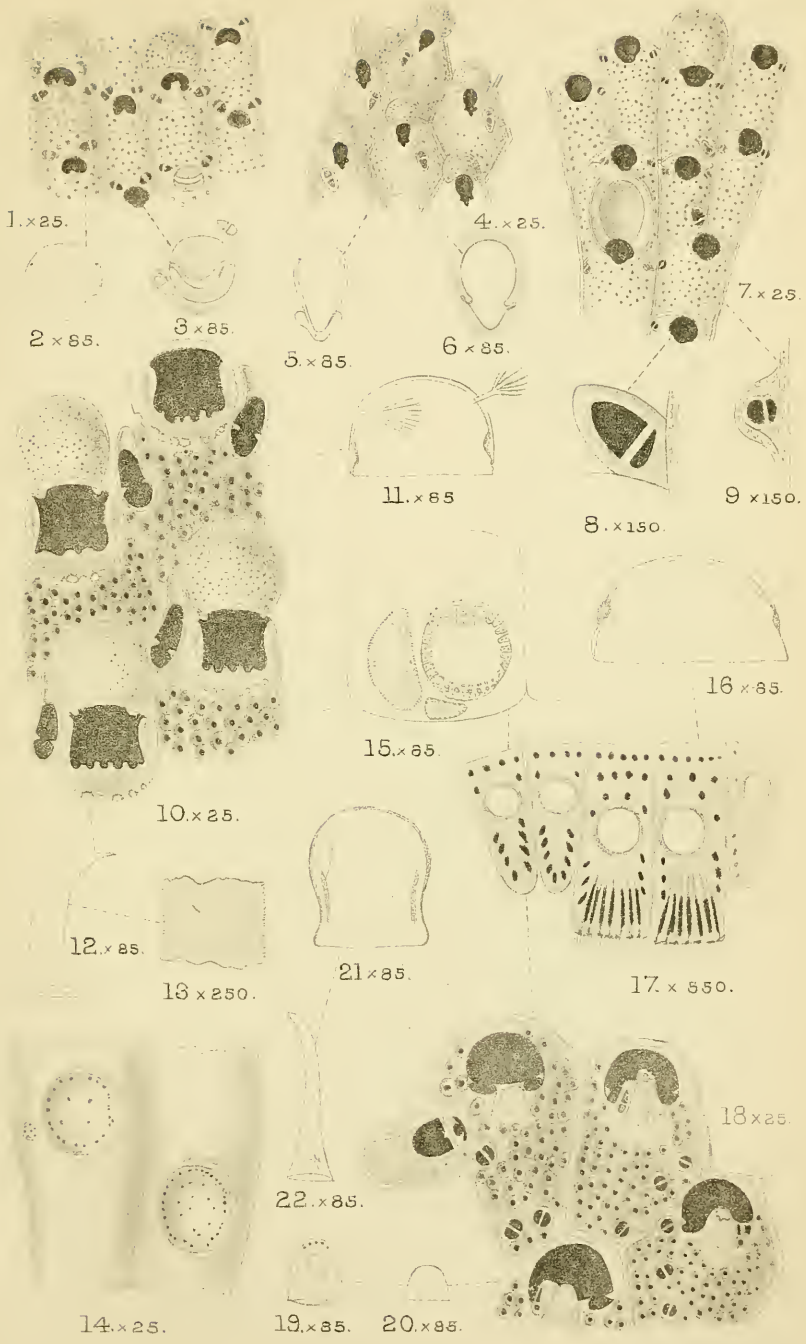
19. x250.

20. x250.

A.W.Waters del.

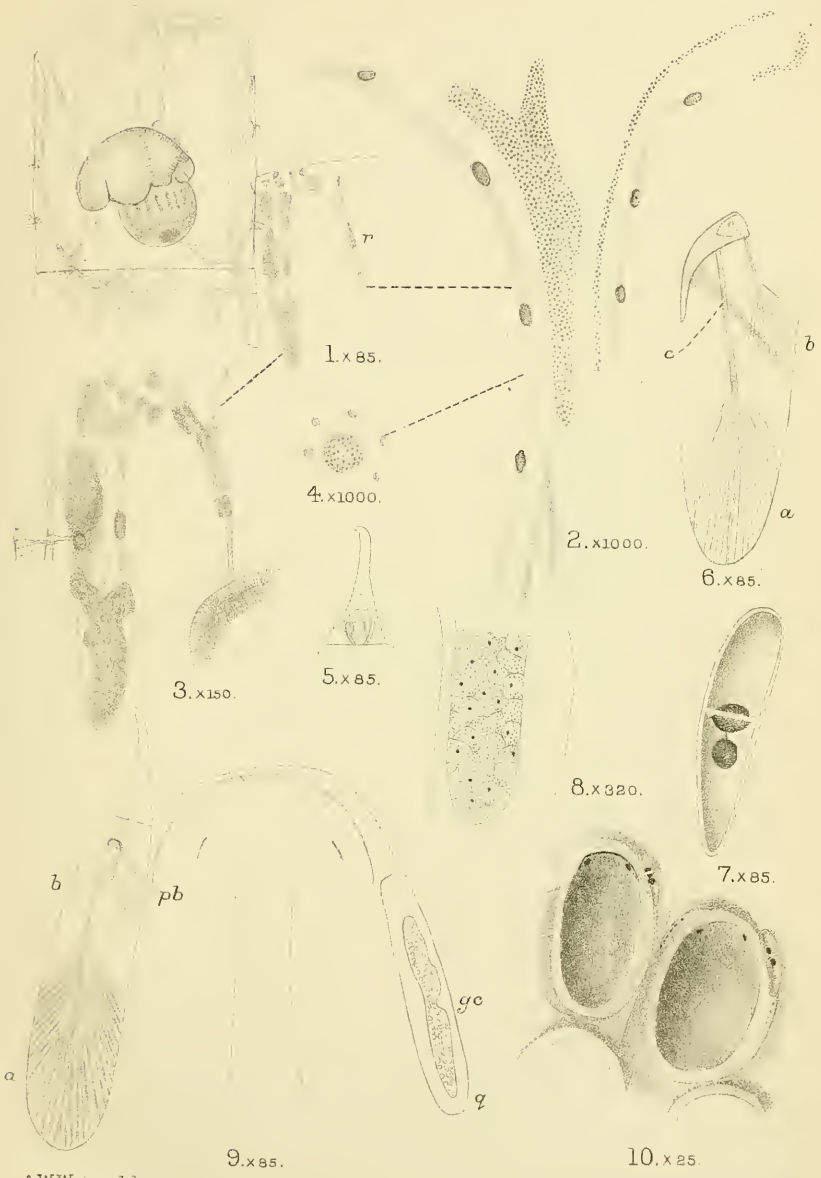
Huth sc.et imp

BRYOZOA FROM ZANZIBAR.

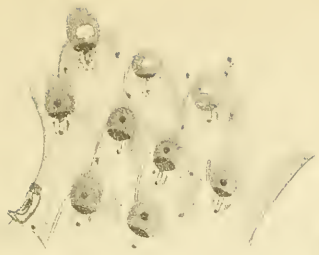


A. W. Waters, del. Huth, sc. et imp.

BRYOZOA FROM ZANZIBAR.



BRYOZOA FROM ZANZIBAR.


1. × 25.


2. × 85.


3. × 50.

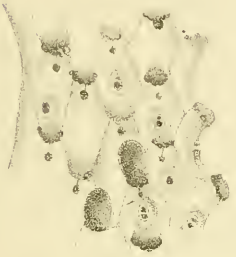

4. × 50.


5. × 50.


6. × 50.


7. × 50.

8. × 250.

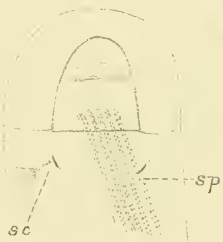

9. × 25.


10. × 50.


12. × 50.

11.


13. × 50.



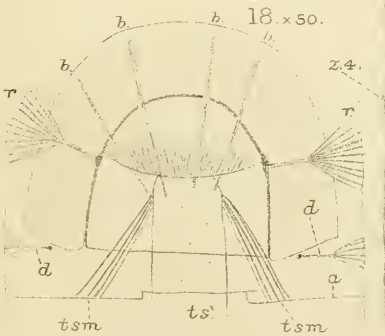
14. × 50.

15. × 250.


16. × 85.

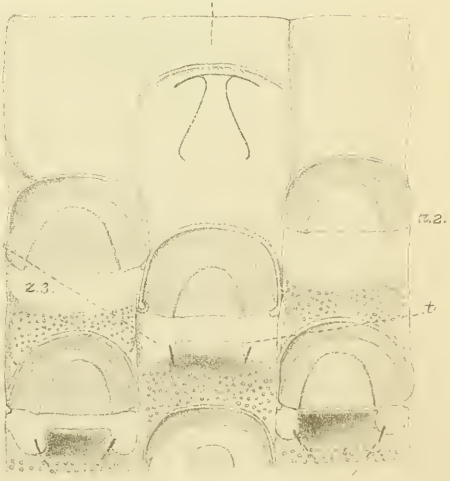
17. × 50.


18. × 50.



19. × 85.

B.



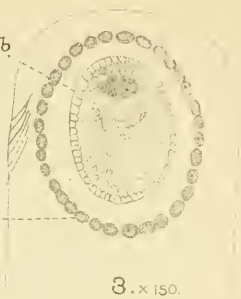
20. × 25.

A.W. Waters, del. Huth sc. et imp.

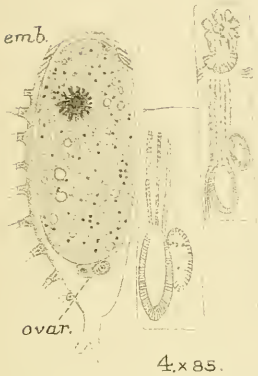
BRYOZOA FROM ZANZIBAR.

1. x 250.

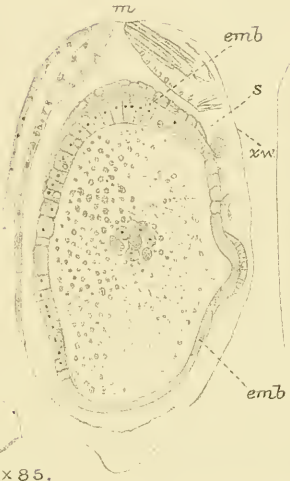
2. x 250.



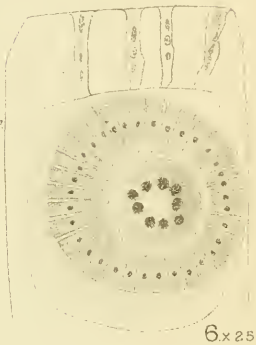
3. x 150.



4. x 85.



5. x 150.

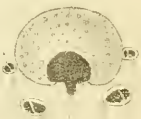


6. x 250.

6a.

7. x 85.

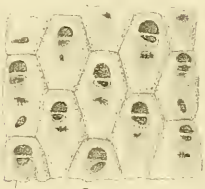
8. x 85.



15. x 50.

9. x 85.

10. x 85.



12. x 25.

13. x 50.

16. x 50.

11. x 85.

A.W. Waters, del.

14. *nat. size*

Huth sc. et imp.

BRYOZOA FROM ZANZIBAR.

(2) The nature of the articulation can be used in grouping the Scrupocellaridæ, the other characters being the ovicells, vibracula (especially the number at a bifurcation), and the band, perhaps a spermotheca at the distal end.

(3) The difference in form and position of the ovaria in *Bugula* and *Scrupocellaria* gives a generic character, and the same is the case in other genera (p. 476). The form of the ovaria is likely to give us considerable assistance in classification, but as the ovaria pass through various stages of development, time and caution are requisite to make it fully available.

(4) In *Membranipora armata* Hasw. there are two mature polypides in most zoœcia, and on one side of the zoœcium there is a long chambered avicularium, whereas on the other side there is a similar long chamber containing a secreting gland (p. 488).

(5) In some species of *Schizoporella* a bar curving towards the sinus is seen across the operculum. This is the commencement of the lower wall of another zoœcial layer, and in many cases the distal walls are seen to extend over the operculum (p. 504).

(6) In *Diplodidymia complicata* Rss. a small ovum starts in a small sac hanging down from the opercular region. Both grow large, and the larva ultimately fills up a large portion of the zoœcium (p. 491).

Some of the species in this collection were also found in Crossland's Red Sea collections, and my report thereon is quoted with a shortened reference *.

This communication may be considered as part of a series dealing with tropical forms, of which three papers on the Red Sea etc. have been published; and I have a small collection from Cape Verde, also collected by Crossland.

From the locality Wasin about 60 species were procured, and from Ras Osowamembe about 30 in all.

Since the examination of this Zanzibar collection was commenced, Levinsen has published his 'Morphological and Systematic Studies on the Cheilostomous Bryozoa,' and we have for some time been anxious to see his ideas on classification developed. He has given the particulars of much valuable detail examination of the calcareous parts of the Bryozoa, and doubtless many of the characters he deals with will receive increased attention, and our knowledge is much advanced by the wealth of observation.

Unquestionably much of his altered classification will be adopted; but if any of us thought that all our troubles would be ended as soon as Levinsen published his results, we find that this is far from being the case. We have to examine each new grouping, and see whether, when other characters are examined, they uphold suggested alterations; also, do other species of the groups fall into place? I already see where some modifications will be required, and no doubt other workers who have carefully

* Journ. Linn. Soc., Zool. vol. xxxi. pp. 123–181, 231–256.

examined Levinsen's great work are coming to similar conclusions, and in this way our starting from Levinsen's standpoint, and using it as a stepping-stone, should ultimately advance the correctness of the classification very much. At present the position remains very difficult, since for a large part we are not sure what will be accepted.

I do not want to be misunderstood as giving an adverse criticism, and so would add that the task was too great to be final, as Levinsen must have fully felt; and we must now be alive to the fact that, in the future, classifications will to a large extent be based upon the structure of the soft parts, which furnish a very large number of characters, some of which are of great value, while others will not be found very useful. For every external character there are many internal ones of importance.

It must be emphasized that, as I have often said *, characters of great value in one group or family are almost useless in the next; and all attempts at fixing certain characters as being of A 1 importance, others of secondary importance, and so on down the scale lead to no result, but we must get together our groups of species based upon as many characters as possible, and gradually build from them larger divisions; and this process must be slow, but it will be natural, whereas the attempt to work from the larger divisions has led to false results.

As a case in point, Levinsen makes great use of the rosette-plates, which I have found in certain cases to give most useful results, in other families none at all; and in tabulating Levinsen's results we find that the family character is often uni- or multi-porous, with or without pore-chambers, that is to say, the character in such cases is of no value for the higher group. In those families in which we should have been most glad of help, namely, in Membraniporidæ, Cribrilinidæ, Microporidæ, Escharidæ, Smittinidæ, it is pore-chambers or uni- or multi-porous rosette-plates, and in eight other families uni- or multi-porous rosette-plates; also in genera we find the same range, so that, while Levinsen's work in this direction is very valuable, care is required lest we attach undue importance to the rosette-plates or any one character.

Where the opercular aperture is not on a level with the frontal surface of the zoœcium there is often a shelf upon which the distal end of the operculum rests, and Levinsen has shown that this is a character of some value; but here, again, we must not expect too much. The value of most of the characters used by Levinsen, even for the main divisions, are still on trial.

Levinsen has followed † Norman in using names given by the

* Page 71. Levinsen expresses these facts as follows:—"The same structural feature in different systematic divisions can have a very different systematic importance, so that characters which are constant in one genus or family, in other corresponding divisions are not always constant even within the species."

† Since I wrote the above, Canu has sharply criticised Norman's suggested alterations of generic names (Rev. Crit. de Paléozool. vol. xvii. p. 49, 1913).

earlier authors in a sense different from that applied to them for generations; and not only that, but generic names now well established are shifted to be used instead of other well-established names. *Cellaria* is to be replaced by *Cellularia*, a name that has been used in numerous senses during the lifetime of most of us. There is no rule obliging us to revert to old names which were made for genera without any adequate and recognisable description; but even if a rule were being broken, we should continue to do so in order to stay the appalling confusion caused by this desire to keep alive a name in its doubtfully supposed original sense. *Cellaria* still means for me what it has meant all my scientific life. I do not accept *Lepralia* as meaning *Membraniporella*, and this Levinsen also refuses to do and gives an amended description of *Membraniporella*; but I am not prepared to accept *Aspidelectra*, and should place *melontha* under *Membraniporella*. Nor is the variously used *Escharoides* a satisfactory name, seeing that it was only given for a subgenus of *Cellepora* based upon characters seen to be useless. *Discopora* is another genus that should have been dropped, as it was quite insufficiently described at first; in fact, the name was given by Lamarck to a Cheilostome and by Fleming to a Cyclostome, so that it has been employed for all kinds of unrelated things, as *Cellepora*, *Haloporella*, *Membranipora*, *Mucronella*, *Smittina*, *Palmicellaria*, *Diastopora*, *Lichenopora*, *Tubulipora*, etc., and has been variously used by palæontologists. It has not been proposed to retain *Discopora* on account of the definition, which now tells us nothing, but from what is supposed to be the first-mentioned species of an incongruous group.

Such changes back to discarded genera add much to the difficulties of those who are closely following all that is written; and are not these premature and puzzling changes of names keeping back new workers from entering the thinning ranks? Until we are sure of the characters, and have enough material to test the relationships, we must often gather information round species and genera the names of which we know will ultimately be changed or disappear.

I have again to thank Mr. Kirkpatrick for allowing me to make frequent comparison with the British Museum collections. The Plates were mostly drawn before the appearance of Levinsen's work, otherwise they would have been slightly differently arranged. Miss Thornely's paper, "The Marine Polyzoa of the Indian Ocean from H.M.S. Sealark," Trans. Linn. Soc. vol. xv. pp. 137–157, has also appeared during the preparation of my paper. It materially increases our knowledge of the distribution of tropical Bryozoa from moderate depths.

Other groups collected by Mr. Crossland from Zanzibar have already been described by specialists in the Proceedings of this Society.

Table of Distribution from West to East.

	Page.	Atlantic.	British.	Mediterranean.	Red Sea.	Indian Ocean. N. = North. S. = South.	Ceylon.	South Africa.	Australasia.	Japan.	Fossil.	
Aetea anguina L.	463	+	+	+	...	...	+	+	+	...	+	N. Pacific.
„ *truncata* Landsb.	465	+	+	+	...	...	...	...	...	...	+	
Brettia tropica, sp. n.	465											
Synnotum aviculare Pieper	465	+	...	+	+	+ N., S.	...	+	+			
„ *pembaensis*, sp. n.	465											
„ *contorta*, sp. n.	466											
Eucratea chelata L.	466	+	+	+	...	...	..	+	+	...	...	California.
Beania spinigera MacG.	467	...	...	...	...	...	...	...	+			
„ *mirabilis* Johnst.	467	+	+	+	...	...	+	...	+	...	...	Pacific, Burmah.
Bicellaria chuakensis, sp. n.	467											
Stirparia exilis MacG.	468	...	...	...	...	...	...	...	+			
„ *zanzibariensis*, sp. n.	469											
„ *dendrograpta*, sp. n.	470	...	...	...	...	...	...	...	+			
Bugula neritina var. *minima* Waters	471	...	...	...	+	+ N., S.	...	...	+			
„ *robusta* MacG.	471	...	...	...	...	...	...	+	+			
Scrupocellaria ferox Busk	476	...	...	...	...	...	...	...	+			
„ *cervicornis* Busk	477	...	...	...	+	...	+	...	+			
„ *macandrei* Busk	477	+	...	+ Hell.	...	+ S.	...	...	+	...	...	Loyalty Isl.
„ *pilosa* Aud.	478											
„ *wasinensis*, sp. n.	479											
Canda retiformis, Pourtales	479	+	...	...	...	+ S.	+	...	...	...	...	Loyalty Isl.
Catenaria lafontii Aud.	481	+	...	+	+	+ N., S.						
„ *diaphana* Busk	482	+										
Vittaticella elegans Busk	484	...	...	...	...	+ N.	+	+	+	+		
„ „ var. *zanzibariensis*, nov.	485											
Membranipora savartii Aud.	486	+	...	...	+	+ N., S.	+	...	+	...	+	
„ *armata* Hasw.	486	...	...	...	...	...	...	...	+	+		
„ *catenularia* Jameson	488	...	+	+	...	...	...	...	+	...	+	
Farcimia oculata Busk	489	+	...	...	+	+ N., S.	+	...	+	...	+	
Diplodidymia complicata Rss.	490	...	...	...	...	...	...	...	...	...	+	New Guinea.
Chlidonia cordieri Aud.	492	+	...	+	+	...	...	...	+			
Cellaria gracilis var. *tessellata* nov.	495											
„ *wasinensis*, sp. n.	495											
Thairopora mamillaris Lamx.	497	...	...	...	...	...	...	...	+			
Steganoporella magnilabris Busk	498	+	...	...	...	+ N., S.	+	+	+	+	+	Brazil.
Cribrilina radiata Moll.	501	+	+	+	+	+	+	...	+	...	+	
Hippothoa distans MacG.	501	.	+	+	...	...	...	+	+			
„ *divaricata* Lamx.	501	+	+	+	...	...	...	+	+			
Schizoporella unicornis Johnst.	501	+	+	+	+	+	...	...	...	+	+	
„ *pertusa* Esper	502	+	+	+	...	+ N.	...	...	+	...	+	Pacific.
„ *nivea* Busk	502	...	...	...	+	+ N., S.	+	+				
„ *montferrandi* Aud.	506	...	...	...	+	+ N.	+	...	+	+		
Gemellipora protusa Thornely	506	...	...	...	...	+ N.	+					
Trypostega venusta Norm.	506	+	+	...	...	+ N.	...	...	+	...	+	Lifu, Mauritius.
Arthropoma cecilii Aud.	508	+	+	+	+*	+ N., S.	+	...	+	...	+	
Osthimosia zanzibariensis, sp. n.	508											
Lagenipora rota MacG.	510	...	...	...	...	...	...	...	+			
Haswellia australiensis Hasw.	511	...	...	...	...	...	...	...	+			
Tubucellaria cereoides var. *chuakensis* Waters	512	..	...	...	...	...	...	+	+			
„ *fusiformis* d'Orb.	512	...	...	...	...	+ N., S.						
„ *zanzibariensis* Waters	512											

* This was not mentioned in my Red Sea paper, but I have a piece from a sounding-line

Table of Distribution from West to East (continued).

	Page.	Atlantic.	British.	Mediterranean.	Red Sea.	Indian Ocean. N. = North. S. = South.	Ceylon.	South Africa.	Australasia.	Japan.	Fossil.	
Smittina trispinosa var. *protecta* Th.	513	+	...	...	+	+N.	+					
„ „ var. *spathulata* MacG.	513	...	...	...	+	+N.	+	...	+			
„ *tropica* Waters	514	...	...	...	+							
„ sp.	514											
Lepralia feegensis Busk	514	...	...	...	...	+N.	+	...	?	...	...	Loyalty Isl.
„ *turrita* Smitt	516	+	...	...	...	+N., S.						
„ *wasinensis*, sp. n.	516											
„ *cleidostoma* var. *inermis* Ort.	517	...	...	...	...	...	..	...	...	+	...	N. Pacific.
Petralia japonica Busk	518	...	...	...	+	+N.	+	+	...	+		
„ *chuakensis*, sp. n.	518											
„ *vultur* var. *armata*, nov.	518											
? *Escharoides occlusa* Busk	519	...	...	...	+	...	...	...	+			
Holoporella columnaris Busk	521	...	...	...	...	+N.	+	...	+	+		
„ *aperta* Hincks	522	...	...	...	+	+N.	+	...	...	...	...	Cuba.
„ *albirostris* Sm.	522	+	...	...	...	+S.	...	...	+	...	+	
Microporella ciliata Pallas	523	+	+	+	+	+N.	+	...	+	+	+	
Rhynchozoon profundum var. *laminatum*, nov.	523											
Retepora hirsuta Busk	523	...	...	...	+	...	...	...	+			
„ *producta* Busk	525	...	...	...	...	+N.	...	...	+	+	+	
„ *denticulata* Busk	526	...	...	...	...	...	...	...	...	+	...	Amboina, Lifu, Sanduri Isl.
„ *jermanensis* Waters	526	...	...	...	+							
„ *tubulata* Busk	526	...	...	...	...	+N.	+	...	+			
? *Bifaxaria vagans* Thornely	527	...	...	...	...	+S.						
Adeonella platalea Busk	529	...	...	...	...	+N.	...	...	+	...	...	China Sea. South Pacific.
Adeonellopsis crosslandi, sp. n.	531											

Hincks records *Lepralia striatula* from Zanzibar.

Aetea anguina Linnæus. (Pl. LXIV. figs. 1 & 2.)

For synonyms see Miss Jelly's Catalogue, and add:—

Aetea anguina Calvet, "Bry. Mar. de Cette," Trav. de l'Inst. de Zool. de l'Univ. de Montpellier, ser. 2, mem. 11, p. 8 (1902); Jullien & Calvet, Bry. prov. des Camp. de l'Hirondelle, p. 122 (1903); Thornely, "Ceylon Pearl-Oyster Fisheries," vol. iv. Suppl. Rep. xxvi. Polyzoa, p. 108 (1905); Robertson, "Non-Incr. Bry.," Univ. Calif. Pub., Zool. vol. ii. No. 5, p. 244, pl. iv. figs. 1-4 (1905); Norman, "Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. p. 283 (1909); Levinsen, Morph. & Syst. Studies on Cheil. Bry. p. 93 (1909); Canu, "Bry. Helv. de l'Egypte," Mém. de l'Inst. Egyptien, vol. vi. p. 190 (1912); Osburn, R. C., "The Bry. of the Wood's Hole Region," Bull. Fisheries Bureau, vol. xxx. p. 220, pl. xxi. figs. 14, 14 *a* (1912).

In the specimens from Wasin I have seen ovicells in the same position as those of *A. recta*, namely, at the top of the tubular projection at the back. This dorsal ovicell has now been seen

in *A. recta* from Rapallo * and Naples in the Mediterranean, and in the 'Belgica' Antarctic material. Miss Robertson describes ovicells on the front, some distance down, but was in doubt as to whether the species was a true *A. anguina*. Whether she really had another species before her or not must be left uncertain, but certainly the front position as drawn by her is a very strange and unexpected one.

Miss Robertson has confirmed what I wrote about the ovaria occurring in the creeping part, and this seems to be the usual place; however, in the present specimens I do not find that the polypide extends far into this part, as it sometimes does in *A. recta* and as Miss Robertson describes and figures in *A. anguina*.

Smitt, Waters, Jullien, and Robertson have all shown that the polypide etc. does not entirely live in the tubular prolongation; but Jullien, although appreciating the fact, called this part the peristome or peristomia. Surely the peristome is something beyond the operculum and is the part where the polypide is only to be seen when extended; so that this term applied to *Aetea* is most unfortunate and misleading. This tubular prolongation has been called the neck, and the terminal portion the spoon, but no satisfactory name has been given to the creeping portion, which is only a part of the zoœcium. There are 12 tentacles.

The diaphragm does not make an infold when retracted, like most of the Cheilostomata; and the appearance of setæ, which has frequently been alluded to, must be caused by a partial extrusion of the diaphragm. In some respects *Aetea* approaches the Ctenostome *Cylindrœcium*, but no Ctenostome has an external ovicell.

I do not altogether understand what Levinsen † says regarding the ovicells of this species; for though the wall of the ovicell is so thin that the embryo can readily be seen, yet decalcified preparations and sections have been studied. If Levinsen means to suggest that the sacs containing the ova and embryos are only accidentally at the termination and might adhere in any position, then this is not the case, as I have now seen a large number, perhaps hundreds, always in exactly the same position, and see no reason why we should not speak of them as ovicells. One section shows the zoœcial wall bulging out and the ovum partly in this portion, which is the commencement of the ovicell ‡.

Loc. Arctic; Atlantic; Mediterranean; Gulf of Manaar; Zanzibar (*Hincks*); S. Africa; Australia; New Zealand, Tasmania; Pacific? (*Robertson*); Tristan da Cunha ('*Challenger*'). Wasin, Brit. E. Africa, 10 fath. (500 §), collected by Crossland.

Fossil. Upper Tert. Italy (*Neviani*), Helvetian of Egypt (*Canu*).

* "Bryozoa from Rapallo," Journ. Linn. Soc., Zool. vol. xxvi. p. 5, pl. i. figs. 1–5 (1896).

† Morph. & Syst. Studies on the Cheil. Bry. p. 93 (1909).

‡ Since the above was written, Prof. R. C. Osburn has confirmed the existence of ovicells in the position described, having found numerous such ovicells in specimens from Fish Hawk Station: see "Bryozoa of the Wood's Hole Region," Bull. of the Bureau of Fisheries, vol. xxx. Document No. 760, p. 220 (1912).

§ These and similar numbers are Crossland's registration numbers.

AETEA TRUNCATA Landsborough. (Pl. LXIV. fig. 3.)

There are only small fragments from Prison Island, Zanzibar Channel. The creeping tube or stolon is dotted in just the same way as the erect tube.

Loc. Arctic; British; Danish; Madeira, Naples, Rapallo, Cette. Prison Island, Zanzibar Channel (505), 8 fath., collected by Crossland.

Fossil. Helvetian, Egypt (*Canu*).

BRETTIA TROPICA, sp. n. (Pl. LXIV. figs. 4, 5.)

There are only the zoœcia figured, and it will be seen that the species is closely allied to *B. australis* Busk, but differs in the shape of the area, which in *B. tropica* is about the length of a zoœcium. There are on the dorsal surface the two light disks * on each side as in *B. longa* Waters, but in *B. tropica* the distal ones are very minute with the proximal one much larger. The lower zoœcium arises from a calcareous knob, from which stolons spread out. The zoœcium is calcareous, and most of the species of *Brettia* are more or less calcareous, but with such small fragments we cannot know much about its relationships.

I found species of *Brettia* in the Arctic and one in the Antarctic, and though the differences are very small it does not seem that the present form can be placed with any of those already described. *Brettia* may have avicularia, but then it has been called *Corynoporella* Hincks.

Loc. Wasin, Brit. East Africa, 10 fath. (501), collected by Crossland.

SYNNOTUM AVICULARE Pieper.

Waters, Rep. Sudanese Red Sea, p. 129.

Loc. (additional). Wasin, Brit. E. Africa, 10 fath. (501); Ras Osowamembe, 10 fath. (504); Meweni Bay, 6 fath. (510).

SYNNOTUM PEMBAENSIS, sp. n. (Pl. LXIV. figs. 12–15.)

Zoarium with a spreading ramifying stolon, from which several erect stems arise, just as in *Stirparia* etc. The stem is about the same size as the creeping stolon, and is smooth for about the length of two or three zoœcia, then there is a short zoœcium followed by the pairs of zoœcia.

The zoœcia are shorter and stouter than those of *Synnotum aviculare* P. At one side at the distal end there is a round pedunculate avicularium, but no sessile avicularium as in *S. aviculare*. The first zoœcium of each branch is uniserial, as is also the case in *S. aviculare*, *Notamia bursaria* L., *Dimetopia*, and *Calvellia*, whereas in *Gemellaria loricata* L. there is a pair of zoœcia at each fresh bifurcation. The pairs of zoœcia turn alternately slightly to right and left, and there are radicles from between the zoœcia just as in *Synnotum aviculare*. There seem

* There are similar disks in *Catenaria* and *Tittaticella*.

to be several pores in the large distal rosette-plate. There are 10 tentacles.

Loc. Wasin, Brit. E. Africa, 10 fath. (501); Chuaka, Zanzibar, 2 fath. (508); Chaki-Chaki Bay, Pemba Island, near Zanzibar (517), collected by Crossland.

Synnotum contorta, sp. n. (Pl. LXIV. figs. 16–18.)

Synnotum aviculare Robertson, "Non-Incrusting Bryozoa," Univ. of Calif. Publ., Zool. vol. ii. p. 286, pl. xiv. figs. 84, 85 (1905).

The zoarium is coiled up, especially at the end. The branches of the zoarium dichotomise, and consist of pairs of zoœcia back to back directed alternately in the opposite directions at right angles.

The zoœcia are wide, subtruncate at the top, diminishing regularly to the base, with a sessile avicularium at one or both sides near the distal end, and there are a few large rounded, pedunculated avicularia replacing one of the sessile avicularia, but none of these are found in the older zoœcia; the area is large, occupying more than two-thirds of the front, and the calcareous layer is much more solid than in any other of the Gemellaridæ examined. The first zoœcia at the bifurcations are single, whereas the next ones are double, being back to back. There are long radicles from the side of the zoœcia. In the lateral wall there are two rosette-plates near the distal end.

There are 11 tentacles.

We know *Gemellaria loricata* L. without any avicularia, *S. pembaensis* nov. with terminal pedunculated avicularia, the present species with sessile avicularia and a few short thick pedunculated avicularia, and *S. aviculare* also with both sessile and pedunculated avicularia. The presence or absence of avicularia is constantly turning out an unsatisfactory generic character, and I have never felt quite satisfied that a new genus was required for *Synnotum*.

Miss Robertson's figure shows the zoœcia more attennated below, but it certainly seems that this is the species she described.

Loc. Chuaka, Zanzibar, 2 fath. (508); Chaki-Chaki, Pemba Bay, near Zanzibar, low water (517); Wasin, Brit. East Africa, 10 fath. (501).

Eucratea chelata Linn.

See Miss Jelly's Catalogue, and add :—

Scruparia chelata Kirchenpauer, Bericht über die Untersuchungs-Fahrt der Pommerania, "Bryozoa," p. 181 (1875).

Eucratea chelata Levinsen, Zool. Danica, p. 42, pl. i. figs. 8–9; Calvet, Bry. de Cette, p. 12; Robertson, "Non-Incrusting Bryozoa," Univ. of Calif. Publ., Zool. vol. ii. p. 248, pl. v. figs. 7–9 (1905); Barrois, Emb. des Bry. p. 194, pl. xv. figs. 10–12 (1877);

Osburn, "Bry. of Wood's Hole Region" Bull. Bur. Fish. vol. xxx. p. 221, pl. xxi. fig. 15 (1912); Nordgaard, "Die Bry. des West. Norwegens," Die Meeresfauna von Bergen, p. 76.

A few zoœcia were seen from Wasin.

Loc. As far north as the Lofoten Islands; Atlantic; British; Mediterranean; California; Australia; S. Africa (*A. W. W. coll.*). Wasin, Brit. East Africa, 10 fath. (501), collected by Crossland.

Beania spinigera MacGillivray.

Diachoris spinigera MacG. Trans. Roy. Soc. Vict. vol. iii. p. 165, pl. ii. fig. 12 (1859); Prod. Zool. Vict. dec. v. p. 32, pl. xvi. fig. 3; Waters, Ann. Mag. Nat. Hist. ser. 5, vol. xx. p. 94 (1887).

There are some small specimens from Wasin which correspond in most particulars, though the avicularia are materially smaller than the type, more like those of *B. intermedia* Hincks. There are three terminal spines and usually 5–6 delicate lateral spines.

Loc. Victoria (Australia); New South Wales. Wasin, Brit. East Africa, 10 fath. (501), collected by Crossland.

Beania mirabilis Johnston.

For synonyms see Miss Jelly's Catalogue, and add:—

Beania mirabilis Hincks, Ann. Mag. Nat. Hist. ser. 3, vol. viii. p. 36 (1862); op. cit. ser. 5, vol. xiii. p. 357 (1884); op. cit., ser. 5, vol. xix. p. 215 (1887); Waters, Journ. Linn. Soc. Zool. vol. xxvi. p. 17, pl. ii. fig. 1 (1896); Jullien & Calvet, 'Bry. prov. des Camp. de l'Hirondelle,' p. 38 (1903); Thornely, Ceylon Pearl-Oyster Fisheries, vol. iv. Suppl. Rep. xxvi. p. 109 (1905); Robertson, "Non-Incrust. Chil. Bry." Univ. of Calif. Publ., Zool. vol. ii. p. 276, pl. xii. figs. 63, 64, & fig. in text (1905).

Loc. Northern; British; French coasts; Atlantic (*Jull. & Calv.*); Mediterranean; Ceylon (*Th.*); Burmah (*H.*); Australia; Pacific coast of N. America (*Rob.*). Meweni Bay, Zanzibar (510), collected by Crossland.

Beania has been considered to belong to the Flustridæ by Busk, and to Bicellaridæ by Levinsen, but the large embryo found by me in *B. magellanica* * seems to indicate the probability of the genus standing elsewhere. There are 20–26 tentacles in *Beania*, whereas in Bicellaridæ and its allies there are usually fewer, 12–18. *B. magellanica* B. has 23–26; *B. hirtissima* Hell., 20–30; *B. hyadesi* Jull., 20; *B. quadricornuta* H., 23 (*W.*); *B. spinigera* MacG., 20; *B. mirabilis* Johnst., 20.

Bicellaria chuakensis, sp. n. (Pl. LXVIII. figs. 7, 8.)

The zoarium arises from a long, erect primary with radicles; it frequently anastomoses, forming a colony about 7–8 mm. high.

The primary zoœcium has an elongate area with nine short

* Ann. & Mag. Nat. Hist. ser. 8, vol. ix. p. 493 (1912).

spines, the next zoœcium has seven spines, while the younger zoœcia have usually three spines, two outer ones and one inner, though there may be occasionally two or four spines instead of three. The area is less than half the length of a zoœcium, and the pedunculate avicularia are placed at about half the height of the area, whereas in *B. ciliata* they are much below it. The avicularia are of moderate size and similar in shape to those of *B. ciliata*; however, avicularia do not occur on any of the lower zoœcia, so that, counting from the primary, no avicularia will be found before about the 18th zoœcium.

The pedunculate ovicell, directed laterally as in *B. ciliata*, is situated on the inner side near the distal end.

Loc. Taken in tow-net, Chuaka Bay, Zanzibar (515); Wasin, Brit. E. Africa, 10 fath. (500), on *Steganoporella magnilabris*; Chuaka, 2–3 fath. (512), collected by Crossland.

Stirparia exilis MacGillivray. (Pl. LXVI. figs. 1–3.)

Stirparia exilis MacG. "Desc. of New or Little-known Polyzoa," pt. xiii. Proc. Roy. Soc. Vict. n.s. vol. ii. p. 107, pl. iv. figs. 1–1 *b* (1890).

In the Wasin specimens the lower part of the stem is buried in sponge and cannot be completely examined; the upper part is annulated for a short space; the rest is smooth, unjointed, and without any strengthening rods, but at irregular intervals there are contractions, or sometimes two or three together, with rosette-plates across the stem in places. Although these stems differ from those of the other two species found, yet they are divided up by these contractions into lengths often about equal to those of *S. dendrograpta*; however, the growth is much simpler, so that, perhaps, *S. exilis* may ultimately have to be placed in another genus. Fresh branches are given off at right angles to the main stem and start from an expanded disk (fig. 3).

The tuft is 5–6 mm. long, and the zoœcia face to the outside of the tuft. There are about 12 tentacles. The area is about two-thirds of the length of a zoœcium; there are three spines, or, in parts two; and only a very few, almost globular, avicularia have been seen (about two in each tuft), and these are short with apparently a wide mandible rounded at the end. The avicularia are attached just below the area and there are no ovicells, only the commencement of one. MacGillivray found neither avicularia nor ovicells.

The opercular opening is low down. At a bifurcation one zoœcium extends up a short distance on the opposite side of the bifurcation (fig. 1), and this is well shown in the British Museum specimens of *S. exilis* MacG., from Port Phillip Heads.

The mounted specimen from the 'Challenger,' named *S. glabra*, is *S. annulata* Mapl., though there are mounts of a stem of a species which are like those of *S. glabra* and *S. dendrograpta*. Busk's figure, however, seems to show *S. glabra* H., so that we have a puzzle; but we may be right in concluding that *S. glabra*

and *S. annulata* were both obtained from the 'Challenger' Station, off Bahia. In the British Museum 'Challenger' specimen there are six spines to the primary of the tuft, not a number as figured; there are no avicularia or ovicells, but there is a central spine in the same position as the avicularium in *S. glabra* H.

Loc. Port Phillip Heads (*MacG.*). Wasin, Brit. East Africa, 20 fath. (522), collected by Crossland.

Stirparia zanzibariensis, sp. n. (Pl. LXVIII. figs. 1, 2; Pl. LXIX. fig. 14.)

The stem throws out branches which may bear a tuft 6–7 mm. long, and the internodes of the stem are approximately equal.

The zoœcia are alternate and turn partly away from each other, that is, the central line of the branch is raised so that the zoœcia slope laterally downwards. The zoœcium is much wider at the distal end than below, and the area is rather more than half the length of a zoœcium. The first zoœcium of a tuft has 9–11 long spines, usually six on one side and four on the other (or dorsal side) with the central spine long; then the second, third, and sometimes fourth zoœcium have several spines, whereas the normal zoœcia have usually only one stout spine at the upper inner angle, though occasionally there is also one at the outer angle.

There is sometimes an avicularium to the second zoœcium, and this and the subsequent avicularia, which are long and narrow, are situated close to the base of the zoœcium.

There are about 14–15 tentacles.

On the lower part of the stem or stolon the radicles are sometimes replaced by capsules, similar to those described in my paper, "Bryozoa from Rapallo," * and they may be filled with bright yellow homogeneous contents. Levinsen † refers to similar capsules as occurring in *Bugula caliculata* Lev.

The ovicells are pedunculate, and there is a calcareous cover over a part only, not exceeding the half of a globe, so that the embryo is thereby but slightly protected, sometimes not at all. The calcareous wall of the ovicell is made of plates deposited from centres and looking like the shell of a turtle.

The ovaria are central immediately proximal to the cæcum, and the testes fill up the proximal part of the zoœcium. No ovarium in my sections has more than one ovarian cell.

The zoarial growth is similar to that of *S. dendrograpta*, sp. n., with the long nodes as depicted in Pl. LXVI. fig. 4; but the tufts are longer, and both the stout spinous processes and the long avicularia are distinguishing characters. There is no line of chitinous thickening as in *S. dendrograpta*.

Loc. West Australia, some imperfect specimens in my collection. Chuaka, Zanzibar, 3 fath. (506), collected by Crossland.

* Journ. Linn. Soc., Zool. vol. xxvi. p. 19, woodcut fig. 6 (1896).

† Morph. & Syst. Studies on Cheil. Bry. p. 102.

Stirparia dendrograpta, sp. n. (Pl. LXVI. figs. 4–9.)

The stems grow from spreading stolons, and at frequent intervals branches occur which may bear tufts of zoœcia or may produce other branches, and both the original stem and the branches are divided into segments approximately equal, though an internode below a tuft is frequently shorter than the others From the base of most of the internodes there is a radicle or a pair with frequently a cervicorn grapnel at the end. The colony may grow to at least 50 mm. long, and the tufts 3–5 mm. long originate from a zoœcium entirely different from the later zoœcia, having more or less the character of a primary zoœcium. When first described the stem of *Stirparia* was considered to be the equivalent of radicles, but this is not the case.

The first zoœcium (figs. 4, 6) has the area a little more than half the length of the zoœcium and is surrounded by eight very long spines, often attaining about four times the length of a zoœcium. The spines of the first zoœcium of a tuft are, however, not bilateral, but are five on one side and three on the other, the smaller number being on the side from which the next zoœcium grows. The next zoœcium has a somewhat similar area, with about five spines, and the avicularium is near the base of the area, while the following zoœcium approximates to the later zoœcia in having the avicularium somewhat higher than in zoœcium no. 2, though still low down. In subsequent zoœcia they are placed still higher, their normal position in the older zoœcia being at the distal end on the outside corner. Typically they may be terminal in the fourth pair of zoœcia, or they may continue lateral until the eighth, and after the appearance of a terminal one subsequent zoœcia are also generally at the corner of the distal end.

The avicularia are short with a distinct beak.

The branches of the tufts do not form a complete cup as in *S. exilis* MacG. and *S. zanzibariensis*, sp. n., and the zoœcia are on the inside of the cup, whereas in the others they are on the outside. The branches of the tuft dichotomise, and the spread-out fan-shaped tuft is 3–5 mm. long, having often ten pairs in succession.

The zoœcia are alternate and diagonal with the area a little more than half the length of a zoœcium, and the full number of spines is three long ones at the distal edge, though many of the lower zoœcia may have one and the younger zoœcia two spines; nor do the same number occur on both sides of a branch, the zoœcia on the outer zoarial side having more spines than those on the inner; with three on the outer, there is often only one on the inner side.

The ring-shaped oblique chitinous thickening, to which Levinsen * refers as occurring in *Bicellaria ciliata* L., is often

* Morph. & Syst. Studies on Cheil. Bry. p. 101. Levinsen puts *B. caliculata* Lev. under *Bugula*, but his Pl. iii. fig. 1 shows the character of *Bicellaria* in having the long tubular proximal part.

quite distinct on the dorsal surface without being seen on the anterior surface; in other cases a mark is seen all round (fig. 4). When put into Eau de Javelle the zoœcium often breaks off at this line, and it is seen that this proximal tubular part is connected at the base with the lower zoœcium through a rosette-plate. A rosette-plate higher up connects with the next younger zoœcium (fig. 7).

The ovicell is lateral and pedunculate, and there are about 12 tentacles.

Radicles may occur in abundance on the lower zoœcia and not merely from the normal position at the proximal end of the node.

Immediately below the cœcum there is a small globular body which, as it grows, is seen to be the ovarium, but in no case has more than one ovarian cell been seen. The same thing occurs in various Cellularidæ.

In many respects *S. dendrograpta* resembles *S. glabra* Hincks, but that species has the stem internodes long and short alternately and also there is no avicularium at the distal end in *S. glabra*. From *S. exilis* MacG., it differs in the internodes being approximately equal and in the different character of the avicularia. *S. exilis* has 6–7 spines on the primary zoœcium.

The graptolite, *Dendrograptus serpens* Hopkinson *, has similar colonies growing on a stout stalk, and the subcolonies and branches are about the same size as those of the *Stirparia*; and some subcolonies I collected in Llandrindod Wells of *D. serpens* H., or a closely allied species, have the branching quite similar to this *Stirparia* and might have been an impress of it, but as competent authorities have found it to be a graptolite, it shows how identical the growth may be in widely different classes. The name is given on account of the superficial likeness.

Loc. Chuaka, Zanzibar, 2 fath. (508), collected by Crossland.

There is a specimen of *S. dendrograpta* from Port Phillip in the British Museum.

Bugula neritina var. minima Waters.

Waters, "Rep. Sudanese Red Sea," p. 136, pl. xi. figs. 4–7, for syn., and add Thornely, "Mar. Polyzoa of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 141.

Loc. N. S. Wales (*W.*); Red Sea (*W.*); Cargados Reef, Providence, 50–78 fath. (*Th.*). Prison Island, Zanzibar Channel, 8 fath. (505); Ras Osowamembe, Zanzibar Channel, 10–20 fath. (514); Chuaka, Zanzibar, tow-net (515), collected by Crossland.

Bugula robusta MacGillivray. (Pl. LXIX. figs. 15, 16.)

Bugula robusta MacG. Trans. R. Soc. Vict. vol. ix. p. 129 (1868); Prod. Zool. Vict. dec. viii. p. 29, pl. lxxviii. fig. 1 (1883).

Bugula capensis Busk, MSS.

* Hopkinson & C. Lapworth, "On the Graptolites of the Arenig and Llandeilo Rocks of St. Davids," Quart. Journ. Geol. Soc. vol. xxxi. p. 665, pl. xxxvii. fig. 3 (1875).

There is a specimen from Wasin which has the zoœcia a trifle smaller than the South African and Australian specimens, and the avicularia are somewhat smaller; however, in a specimen in my collection, determined by Busk as *B. capensis* *, there is one small avicularium, while the rest are large. There is no real spinous process at the outer angle, but neither do I find more than a projection in any of my specimens from other localities.

The distal rosette-plates are all close to the basal wall and very small, so that it is difficult to distinguish them. In some other *Bugulæ* they are similarly situated, though in others they are spread over the wall. There are no ovicells in this specimen, but the species has lateral ovicells like those of *B. neritina* L., and the brown colour suggests its belonging to the *neritina* group.

The primary zoœcium is very long and narrow, followed by a second long one, then a zoœcium about the ordinary length, after which the growth is biserial. The first two zoœcia remind us of the segments of the stem of various *Stirpariæ*.

Bugula, as a rule, shows no articulation, but *B. reticulata* B. is distinctly articulated—that is, at the bifurcation there are distinct thick articular chitinous tubes.

Other tropical species of *Bugula* are:—*B. dentata* Lamx., *B. mirabilis* B., *B. versicolor* B., *B. reticulata* var. *unicornis* B., *B. gracilis* B., *B. neritina* var. *rubra* Thornely, *B. neritina* var. *tenuata* Th., *B. neritina* var. *ramosa* Th. These last two in many particulars resemble *B. reticulata* Busk. Most of the tropical species have a very wide distribution.

Loc. Victoria (*McG.*); South Africa (as *capensis*); Port Elizabeth, S. Africa (*A. W. W. coll.*). Wasin, Brit. E. Africa (501), collected by Crossland.

Scrupocellaridæ.

Levinsen † does not consider that *Menipea* can be divided up, as I ‡ proposed, by the character of the jointing, and on p. 133 gives his account of the articulation of "all Bryozoa that occur in jointed colonies," but his account is not exhaustive. Dealing now with much more material than on the previous occasion, my suggestion is more fully tested.

The jointing in the Scrupocellaridæ varies considerably, giving useful specific characters, and it is most important that we should trace it from its simplest to its most complicated condition. As I have shown, in most articulated Bryozoa the branches are at first continuous, and the last two or three bifurcations may show no sign of rupture, which only takes place after the chitinous tubes have been formed; and in most articulated Bryozoa the chitinous tube is formed within the calcareous wall, though in some it may be formed merely within the membranous

* See my remarks, Journ. Linn. Soc., Zool. vol. xxxi. p. 137 (1909).
† Morph. & Syst. Studies on the Cheil. Bryozoa, p. 133 (1909).
‡ Journ. Linn. Soc., Zool. vol. xxvi. p. 2 (1896).

wall. Usually, in Scrupocellaridæ, the inner zoœcium of the new pair is jointed close to the proximal end (Pl. LXVIII. fig. 14), but the position of the articulation of the outer zoœcium varies considerably, having the part below the articulation much larger than the similar portion in the inner zoœcium. There are three exceptions to this rule—*Menipea cirrata* Ell. & Sol., *M. smittii* * Norm., *M. flagellifera* Busk—all three of which are without a scutum †.

A.—Beginning with what seems to me the simplest form of articulation, namely, that found in *Canda retiformis* Pourt. (Pl. LXIX. fig. 6), though both genus and species have previously been described as non-articulated in consequence of the chitinous tube being often entirely covered by the calcareous wall, in which as yet there is no rupture, so that decalcification is necessary in order to study the articulation. As mentioned on p. 480, in the younger branches no articulation is found, but in the older ones there is a chitinous tube on the inside of one of the two branches and a similar tube on the opposite side in the next branch, and so on alternately (fig. 6).

B.—From the simple form of *Canda*, we pass on to that of *Scrupocellaria* with two chitinous tubes, but with the outer zoœcium having the articular tube near the middle of the zoœcium (Pl. LXIX. fig. 8). As an example, *S. jolloisii* Aud.

C.—In the following group the chitinous tube in the outer zoœcium is very much lower than in B, but is not, however, close to the proximal end of the zoœcium. The articular tubes are here narrower, more distinct, and often separated as in *Menipea patagonica* Busk (Pl. LXIX. fig. 11). As examples, *M. ternata* Ell. & Sol., *Bugulopsis peachii* Busk (Pl. LXIX. fig. 10), *M. occidentalis* Trask, *M. porteri* MacG.

D.—We pass next to a group in which both articular chitinous tubes are close to the proximal end of the zoœcia. I spoke of the proximal ends of these new zoœcia as small chambers, but now consider that it would be better to compare them with the "basis rami" (*Harmer*) of *Crisia*, and think the designation may be used here, remembering that they are really the beginnings of new zoœcia. As examples, *Menipea buskii* W. Th. (Pl. LXIX. fig. 12), *M. crystallina* Gray, *M. cervicornis* MacG., *M. occidentalis* Trask, *M. cirrata* Ell. & Sol.

* Waters, "Bryozoa from Franz Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. pl. vii. fig. 8 (1900).

† As I have always noticed the articulation when opportunities have presented themselves, several have been carefully figured. In my paper on "Bryozoa from Rapallo," Journ. Linn. Soc., Zool. vol. xxvi. pl. i. the position of the polypides in the zoœcia of *Scrupocellaria inermis* is shown, figs. 11, 12, and *op. cit.* vol. xxviii., the joints of *Menipea gracilis*, pl. vii. fig. 12, *Scrupocellaria scabra*, fig. 14, and *S. smittii* Norm., fig. 8, are shown. In the last the articulation only occurs beyond the distal end of the outer zoœcium. In the present paper the articulation is shown in Pl. LXVIII. fig. 14.

E.—Lastly, *Menipea cyathus* Wy. Thomp. has only one chitinous tube (Pl. LXIX. fig. 13). In Scrupocellaridæ there is, in some species near the distal end, a long body which may be folded back as in *S. ferox* Aud. (Pl. LXVIII. fig. 14), or it may be very long, extending to the proximal end of the zoœcium as in *M. flagellifera* Busk. There is much to suggest that this functions as a testis, and that it should be compared with the organ in *Flustra abyssicola* Sars, and *Cribrilina figularis* Johnst.

The classificatory groups may now be considered:—

1. Canda. Articulation simple as A, p. 473; ovicell smooth, imperforate; vibracula have the setæ serrate. Two vibracula at a bifurcation. Levinsen considers that the ovicell is enclosed in the widened proximal half of the avicularium, whereas I should say that the avicularium is on the ovicell.

2. Caberea. Articulation internal tubes, ovicell imperforate, vibracula with smooth setæ.

3. Scrupocellaria (div. 1). Articulation as B, p. 473; ovicell smooth, imperforate, usually with two vibracula at a bifurcation; setæ smooth. This includes *S. delilii* Aud., *S. scruposa* L., *S. scabra* Van Ben., *S. cervicornis* Busk, *S. macandrei* Busk, *S. ornithorhynchus* W. Th., *S. scrupea* var. *dongolensis* Waters. (*S. scabra* has sometimes one vibraculum at a bifurcation.)

4. Scrupocellaria (div. 2). Articulation as B, p. 473; ovicell perforated, usually one vibraculum at a bifurcation, setæ smooth. This includes *S. bertholettii* Aud., *S. jolloisii* Aud., *S. mansueta* Waters, *S. reptans* L., *S. ferox* Busk, *S. obtecta* Haswell, and probably *S. porteri* MacG., and *S. occidentalis* Trask.

5. Bugulopsis. Articulation as C, p. 473; ovicell imperforate, no vibracula. Example, *B. peachii* Busk. I follow Levinsen in using this generic name for the present, but have not had the opportunity of fully studying the genus.

6. Menipea (div. 1). Articulation as D, p. 473; ovicell truly endozoœcial, showing no external difference, no vibracula; avicularia sometimes suboral and sometimes lateral, short internodes. This includes *M. cirrata* Ell. & Sol., *M. crystallina* Gray, *M. cervicornis* MacG.

7. Menipea (div. 2). Articulation as E, p. 474. Two zoœcia in an internode, scutum directed downwards from the distal end of the zoœcium *. Possibly a new genus will have to be made for this. This includes *M. cyathus*.

Flabellaris. Levinsen leaves in *Menipea* species that cannot be referred to any other of the genera, and puts under it what I

* Specimens of *Menipea fuegensis* Busk and *M. aculeata* Busk have cases of one zoœcium of a new branch growing from the distal end of the terminal zoœcium and also one from the side of the lower zoœcium.

placed in a new genus *Flabellaris* *, and I then showed that *Craspedozoum* MacGillivray must be united with one of the types of *Menipea* Lamx., namely *M. flabellum* Ell. & Sol., but it seems better to keep the name *Menipea* for the first species mentioned by Lamouroux, namely *M. cirrata* Lamx. However, this group of *flabellaris* does not seem to belong to the Scrupocellaridæ at all, but to the Membraniporidæ, having a Membraniporidian oviceli much like that of *M. lineata* L., *M. craticula* Alder, *M. unicornis* Flem. The species included are *F. flabellata* Ell. & Sol., *F.* (*M.*) *cuspidata* Busk (Pl. LXIX. fig. 9), *F. triseriata* MacG. (specimens in my collection have ovicells), *F.* ("*Craspedozoum*") *roborata* Hincks, *F.* (*C.*) *ligulatum* MacG., *F. multiseriata* Busk. *F. roborata* and *F. ligulatum* when broken through have at the articulation interior tubes like the radicles.

The ovaria of *Flabellaris roborata* are distal with many ovarian cells, and one or more grow to a considerable size. Jullien † considered that *Menipea* must be merged in Scrupocellaria in consequence of having found one vibraculum on *Menipea clausa* Jull. = *Scrupocellaria marsupiata* Busk, and this conclusion he considered was upheld by the fact that some colonies of *S. scabra* Van Ben. have no vibracula, while others have a few or sometimes many. This seemed quite reasonable, and since then the idea has received further support, as Levinsen has found one vibraculum on *M. ternata*, and, also, he found vibracula on *Menipea benemunita* Busk of the 'Challenger,' for which Levinsen proposed the genus *Caberiella*. Also, the form and position of the radicle chamber in *Scrupocellaria serrata* Waters ‡ suggests that a recent ancestor had vibracula.

Although these cases prove that the presence of vibracula does not give a sharp divisional line between what has been understood as *Scrupocellaria* and *Menipea*, yet all the species could scarcely remain in one genus, and separation can be made on other grounds. The presence of avicularia gives but very limited assistance in classification, although there are characters in the avicularia which are very useful; so it is, therefore, not surprising to find that in some species vibracula may be found as an exception.

Most of what have been called *Menipea* have an anterior avicularium immediately below the area or slightly to one side, though there are some species without any, as *S. inermis*, nor are lateral avicularia universal.

Levinsen § considered that *Caberea* and his *Caberiella* had the avicularium divided into two chambers, whereas I was unable to find two, for while there is a prolongation of the vibracular chamber, this only seems to be for the groove in which the

* Waters, "On Membraniporidæ," Journ. Linn. Soc., Zool. vol. xxvi. p. 672, pl. xlviii. figs. 10, 11; xlix. figs. 7–10 (1898).

† 'Cap Horn,' p. 69 (1888), and Bull. Soc. Zool. de France, p. 507 (1882).

‡ Report on Red Sea Bryozoa, Journ. Linn. Soc., Zool. vol. xxxi. p. 133, pl. x. figs. 11–14 (1909).

§ Morph. and Syst. Studies on the Cheil. Bryozoa, p. 134.

vibracular seta lies. Exactly the same thing, though not so marked, is seen in *Scrupocellaria*, for in several species the vibraculum extends beyond the median line, as in *S. macandrei* Busk, *S. incurvata* Waters, etc.

As I told Dr. Levinsen that I did not find two chambers, he kindly sent me some vibracula, skilfully separated, which, however, only confirmed what I had seen in my own specimens.

In the Scrupocellaridæ, so far as I have seen, the ovaria are large, situated near the distal end, and contain several ova which are developed into large ova before they pass into the ovicell. On the other hand, in *Bugula*, *Bicellaria*, etc., the ovaria are, at the proximal end, usually very near to the base of the cæcum; they are very small with usually two small ova, and when still extremely small, an ovum passes into the ovicell. It is very interesting to find these generic differences in the ovaria, and undoubtedly the form, size, and position of the ovaria will be found to furnish useful characters in many species of Bryozoa.

The direction of evolution of the Scrupocellaridæ seems to be indicated in the articulation, and a comparison of the changes in this family may help us to understand the Catenicellidæ better.

Scrupocellaria ferox Busk. (Pl. LXVIII. figs. 11–15; Pl. LXIX. figs. 7, 20.)

Scrupocellaria ferox Busk, B. M. Cat. Mar. Polyzoa, p. 25, pl. xxii. figs. 1, 2, & 5.

The avicularia vary considerably in size, being largest just below a bifurcation, and smallest or wanting in the younger zoœcia. The avicularian chamber has the lateral projection to which I referred and figured in *S. mansueta* Waters*, from the Red Sea, and the long dorsal opening of the vibracular chamber in the older zoœcia has a calcareous band across dividing it in two (see fig. 14). There is one vibraculum to a bifurcation somewhat directed towards the front, as in *S. cyclostoma* Busk, and the radicle, which is hooked at the end, is not ringed as in *S. cyclostoma*, but there are only a few complete radicles in the specimens. No ovicells occur on the Zanzibar specimens.

There are about 24 tentacles.

The rosette-plate into the vibracular chamber is at the base of the chamber and has many pores; as this rosette-plate is not always very distinctly marked off these pores might be looked upon as several plates. Each zoœcium has its own lateral wall, so that when prepared in Eau de Javelle they may separate. Stained preparations show a band near the distal end bent back upon itself (fig. 12 *b*). The contents are granular, with hollow places at intervals, and probably the function is the same as in the bodies† I mentioned in *Bugula bicornis* Busk‡, and they

* Journ. Linn. Soc., Zool. vol. xxxi. p. 134, pl. x. fig. 15 (1909).

† Those on page 474 are compared with somewhat similar structures in *M. flagellifera* B., *Flustra abyssicola* Sars, and *Cribrilina figularis* Johnst.

‡ Résult. du Voyage S.Y. Belgica, "Bryozoa," p. 21, pl. i. fig. 4 (1904).

are probably testes, or connected with the testes, and in all the specimens prepared these bands are found in all the zoœcia, but there are no traces of ovaria, so it may be that the male organs are on one colony and the female on another.

In one mount with about 130 zoœcia all contain fully developed polypides, showing that degeneration does not always take place at such short intervals as has been often stated. There are, however, large buds developing by the side of the active polypides.

Loc. Louisiade Archipelago, Bass's Straits (*B.*). Prison Island, Zanzibar Channel (505), 8 fath.; Ras Osowamembe, Zanzibar Channel, 10 fath. (504 & 514); Wasin, Brit. E. Africa, 10 fath. (507), collected by Crossland.

Other species of tropical *Scrupocellaria*, not however found in the Crossland collections, are *S. delilii* Aud.; *S. ornithorhynchus* B.; *S. ciliata* Aud.; *S. annectans* MacG.; *S. diadema* B.; *S. minuta* Kirkp.; *S. clypeata* Hasw.; *S. obtecta* Hasw.

Scrupocellaria cervicornis Busk. (Pl. LXIX. figs. 3, 4.)

Waters, "Rep. Sudanese Red Sea," p. 166.

Loc. add Ras Osowamembe, 10 fath. (504); Wasin, Brit. East Africa, 20 fath. (522), collected by Crossland.

Scrupocellaria macandrei Busk. (Pl. LXVIII. figs. 5, 6.)

Scrupocellaria macandrei Busk, B. M. Cat. Mar. Polyzoa, p. 24, pl. xxiv. figs. 1–3; and add to Miss Jelly's synonyms:—Haswell, W. A., "Polyzoa from the Queensland Coast," Proc. Linn. Soc. N. S. Wales, vol. v. p. 37; Philipps, "Rep. on the Polyzoa," Willey's Zool. Results, pt. iv. p. 442 (1899); Calvet, 'Exp. Scient. du Travailleur et du Talisman,' p. 375 (1907); Thornely, "Mar. Polyzoa of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 140 (1912).

This belongs to the *S. scrupea* group. There are three outer spines and one inner near the peduncle of the scutum. The outer spines are often very long. The groove of the vibraculum is continued beyond the vibracular chamber, passing the median line of the zoœcium, in this respect somewhat resembling *S. incurvata* Waters. There are two vibracula at a bifurcation. The ovicell is smooth, placed somewhat diagonally, and has a clear space on the front. The vibracular seta is about the length of a zoœcium, smooth but flat in the middle, so that perhaps we may call it sickle-shaped. The oral aperture is placed diagonally back, as in *Caberea darwinii* Busk.

Loc. Cape Verde Island, 1070–1150 fath. (*B.*) & 110–180 met. (*Calv.*) & Crossland Expedition; St. Paul's Rocks, N. Atlantic (*B.*); Coast of Spain (*B.*); Adriatic (*Heller*); Lifu (*Phil.*); Queensland (*Haswell*); Providence, 50–78 fath., Amirante, 29 fath., Farquhar Reef, Cargardos, 30 fath., and Seychelles, 34 fath.

(Ind. Ocean, *Thornely*). Prison Island, Zanzibar Channel (505), 8 fath., coll. by Crossland.

Scrupocellaria pilosa Savigny & Audouin (*non* Busk). (Pl. LXVIII. figs. 3, 4.)

Crisia pilosa Aud. Description de l'Égypte, Hist. nat. p. 241; Savigny's pl. xii. figs. 1_1–1_5.

Cellularia spatulata d'Orb. Pal. Franç., Terr. Crét. p. 50 (1850–52).

Some dried specimens from Wasin, B. E. Africa, seem to be the species figured by Savigny. The zoœcia are narrow, producing a wavy appearance, as figured by Savigny. The opesium has a very narrow border, and the scutum, which varies in shape, is small and does not nearly cover the aperture. Both the distal and proximal ends of the scutum are rounded, with the distal end the larger, and the scutum is without cervicorn marks. There are two or three oral spines on the outer side and one or two on the inner, the outer ones, especially the lower one, which is stouter, are sometimes long, though in the specimens they are mostly broken off. The vibraculum is small, partly free at the outside of the zoarium, with the groove extending slightly beyond the vibracular chamber, but not as much so as in *S. macandrei* B. The vibracular setæ are smooth and rather longer than a zoœcium. The zoarium at a bifurcation has a medium spine and one vibraculum. The lateral avicularium is placed somewhat diagonally, instead of standing straight out. The radicles are large and are serrate near the ends.

There are no ovicells on the specimens.

Busk in the 'Challenger' Report, p. 24, describes a species from the southern hemisphere as *S. pilosa* Sav., but this seems a doubtful determination, for the shape of the scutum is different and the vibracular chamber is very wide and large.

Busk speaks of it as the species of Audouin, whereas Audouin calls it the species of Lamouroux, and supported the identity on Lamouroux having presented some of the type to M. Bory de St. Vincent which was compared. However, it was never the species of Lamouroux but of Pallas, and while his description would tally with this species, it would equally well cover a large number of other *Scrupocellariæ*. D'Orbigny gave the name *spatulata* to Savigny's figure, and in the same way he named many of Savigny's other figures, although already named by Audouin. Savigny having given recognisable figures, we may suppose that Pallas and Lamouroux were dealing with the same thing, although this can never be known with certainty.

This is much like *Scrupocellaria pusilla* Smitt, which, however, has cervicorn markings on the scutum.

The various species now considered might well be ranged round *S. scrupea* as varieties.

Loc. ? Mediterranean (*Pallas*, etc.). Wasin, Brit. East Africa, 10 fath. (500), collected by Crossland.

Scrupocellaria wasinensis, sp. n. (Pl. LXVIII. figs. 9, 10; Pl. LXIX. figs. 17–19.)

Zoarium usually with 5 or 7 zoœcia in an internode. Zoœcia wide, with the round area occupying more than half the length of the zoœcium: at the distal end there are three exterior spines and one interior; the anterior avicularia are medium-sized, raised, tubular, with a narrow triangular mandible; the lateral avicularia are very small; the vibracular, together with the radicular chamber, is about half the length of a zoœcium, the delicate vibracular setæ are smooth and slightly longer than a zoœcium; the vibracular chamber is separated near the base from the radicular chamber, and the distal end is contracted. There is one vibraculum at a bifurcation. A few large lateral avicularia have been seen which are divided at the end, and the mandible is forked like that of *S. serrata* Waters *.

The globular ovicell has numerous pores.

The radicles sometimes pass from one branch to another, as in *Caberea retiformis* Sm.

There are about 16 tentacles.

The ovaries containing many ova are at the distal end, while testes in the same zoœcia are at the proximal end. The ovaria in *Scrupocellaria* contain several ova, but the ovaria in this species are peculiar, as there are at first a number of large homogeneous cells of which usually only one or two show any nucleus (Pl. LXIX. fig. 19). The ovaria at this stage show no follicular wall, but at a later stage, when the yolk-mass of an ovum has become very large, then the follicular wall is distinct.

In this species, as in other *Scrupocellariæ*, a large ovum passes into the ovicell, whereas in *Bugula* the ovaria instead of being distal are proximal, and a small ovum in a very early stage passes into the ovicell†. The ovarian cells, which are frequently far apart, are often surrounded by a protoplasmic network which passes up to the rosette-plate of the next zoœcium (figs. 18, 19). This species is of about the same size as *S. mansueta* Waters, but has four distal spines and a much smaller vibraculum, with setæ more delicate, and about half to one-third the length of the latter form. The large lateral avicularia are known in *S. varians* Hincks, *S. serrata* Waters, and *S. obtecta* Haswell, but apparently are only the ordinary avicularia more developed.

Loc. Wasin, Brit. East Africa, 20 fath. (522), collected by Crossland.

Canda retiformis Pourtales. (Pl. LXIX. figs. 1, 2, 6.)

Canda retiformis Pourtales, Bull. Mus. Comp. Zool. Harvard Coll., I., No. 6, p. 110 (1867); Philipps, "Rep. on Polyzoa," Willey,

* "Bryozoa of Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. p. 133, pl. x. fig. 11.

† In *Bugula* there are two small ova in each ovarium, occasionally three, or even four, small ones; however, in *B. murrayana* Johnst., now called *Dendrobeania* by Levinsen, the ovarium is distal, and the ova in the ovarium grow to a large size, so that the material differences in the ovaria would alone suggest that *murrayana* does not belong to the same genus as *B. avicularis*, etc.

Zool. Results, pt. iv. p. 441, pl. xlii. fig. 1 (1899); Thornely, "Mar. Polyzoa of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 141 (1912).

Caberea retiformis Smitt, "Floridan Broyzoa," pt. i. p. 16, pl. v. figs. 43–46 (1872); Thornely, "Ceylon Pearl-Oyster Fisheries," vol. iv. Suppl. Rep. xxvi. p. 109 (1905).

? *Canda fossilis* Waters, Q. Journ. Geol. Soc. vol. xxxvii. p. 322, pl. xvi. figs. 51, 52 (1881); MacG. "Tert. Polyzoa of Victoria," p. 25, pl. iii. figs. 12–14, Trans. R. Soc. Vict. vol. iv. (1895).

The specimens from Zanzibar have the scutum very narrow, pointed distally, and rounded proximally, as described by Miss Philipps, and I follow her in considering them to be the form described by Smitt, and although allied to *C. arachnoides* they seem quite distinct. It occurs in the Atlantic, the Indian Ocean, and the Loyalty Islands, without any connecting links being known. *Caberea crassimarginata* B., of the 'Challenger,' and *Scrupocellaria clypeata* Haswell, seem to belong to this group.

No anterior avicularium has been described, but sometimes there is one attached to the inner side of the zoœcium, and then it is usually just below a bifurcation. The avicularian chamber is wide, and the mandible is triangular. There are two vibracula at a bifurcation.

Both Smitt and Levinsen have considered this species as having no articulation, and as the chitinous tube is often entirely covered by the calcareous wall in which there is as yet no rupture, it requires decalcification to study the articulation, which is peculiar and seems to differ from that of any other species examined. In the younger branches there is no sign of articulation, but in the older ones there is one chitinous tube on the inside of *one of the two* branches, but not of both, and a point to be noticed is that when the chitinous tube is on one side, say to the right, it is in the next branch on the left, in the one following on the right, and so on alternately, though in a few cases in the older parts of the colony I have seen a chitinous tube to each branch. In *C. arachnoides* Lamx., as I have shown*, there are two chitinous tubes, one on the inside of each branch. The articulation of *C. tenuis* MacG. is somewhat similar.

When decalcified, a chitinous tube is shown in the peduncle of the scutum, just as is seen in the base of many spines.

Near the base of the vibracular seta there is a projecting delicate free arch at right angles to the axis of the seta, and in other species of the Scrupocellaridæ there seems to be a similar structure, though not so pronounced.

One of the cross radicle tubes usually connects the two new branches at a very short distance from the bifurcation, and this may partly account for rupture at the articulation so seldom taking place (see fig. 1).

* Ann. Mag. Nat. Hist. ser. 5, vol. xx. p. 89, pl. iv. fig. 7.

There are about 16 tentacles.

The vibraculum of *Canda retiformis* is of the same character as that of *Scrupocellaria*, in which genus some of the vibracular chambers extend beyond the median line of the zoarium, though not quite as much so as in the two species of *Canda*; also the vibraculum of *Caberea* has the same general character.

I have several times maintained* that there are material differences between avicularia and vibracula, but that the length of the mandible or seta is of no importance in indicating which they are. The distinctions are in the chamber and the basal part of the chitinous organs. While the mandibles of avicularia are symmetrical and have the closing muscles attached by †one or two long tendons, the base of asymmetrical seta of the vibracula is very complicated with a large number of curiously shaped protuberances, to some of which the muscles are attached by a fascia, but without any long tendon, so that instead of there being two main muscles, there are more attached by a short band to various parts of the base of the seta. The vibracular base is very small, so that it is difficult to follow this complicated mechanism; the reason for this complication is found in the seta being movable in all directions, whereas the mandibles of the avicularia only move in one. The mandibles all have a straight proximal edge, but this is not the case in the seta; further, the avicularian mandible works from this straight base either against the calcareous bar, or, in case this is not complete, then from two teeth. The universal movement could not take place with a cross-bar, and none has been found, nor must we ever expect to find one in vibracula. The vibracular chambers of this group are different from those of *Cupularia*‡, etc., in which the vibracular chamber takes the place of a zoœcium.

Loc. Florida, 68 & 270 fath.; Loyalty Islands (*Ph.*); Galle, deep water (*Th.*); Amirante, 23–29 fath., Saya de Malha, 55 fath., Seychelles, 39 fath., Cargados, 30 fath. (*Thornely*). Wasin, Brit. East Africa, 10 fath. (501); Prison Island, Zanzibar Channel (505), 8 fath., Ras Osowamembe, Zanzibar Channel, 10 fath. (504), collected by Crossland.

Catenaria lafontii Audouin.

Waters, "Rep. Sudanese Red Sea," p. 131.

Near the distal end there are small ovaria with two ovarian cells.

Loc. Wasin, Brit. East Africa, 10 fath. (501); Prison Island, 8 fath.; Chuaka, 2 fath. (508), 3 fath. (526); Meweni Bay, 6 fath. (510); Zanzibar town, shore (527).

* Résultats du Voyage du S.Y. Belgica, "Bryozoa," p. 27. Zool. Chall. Exp. vol. lxxix. p. 22, pl. i. fig. 12.

† See page 529.

‡ Very minute glands occur in the vibracula of *Cupularia*.

CATENARIA DIAPHANA Busk. (Pl. LXIV. figs. 6–11.)

Scruparia diaphana Busk, Q. J. Micr. Sc. vol. viii. p. 281, pl. xxxi. fig. 1 (1860).

Catenaria diaphana Busk, "Polyzoa," Zool. Chall. Exp. vol. x. pt. xxx. p. 14, pl. ii. fig. 3 (1884).

Halysis diaphana Norman, "Polyzoa from Madeira," Journ. Linn. Soc., Zool. vol. xxx. p. 296 (1909); Levinsen, Morph. & Syst. Studies on Cheil. Bryozoa, p. 274 (1909).

The ovicell has not before been described, in fact Levinsen says it is wanting. A growth of the outer calcareous wall of this recumbent ovicell projects forward from the distal end in the middle and also from the sides, forming at first one elongate space which is subsequently divided, making two vacant spaces or large pores. The node with an ovicell or ovicells is never a single zoœcium, and there are often many zoœcia with ovicells in a node (fig. 9); six together have been counted many times. We have seen many ovicelligerous zoœcia in a node in Catenicellidæ. The node may, however, be only one ovicelligerous zoœcium followed by an ordinary zoœcium. As a rule, from the distal end of the older zoœcium a new zoœcium arises in the median line, and there may also be one growing laterally from very near the end, or occasionally one on each side.

The front wall is but little raised and is perforated, the perforated part being bounded on each side by a raised ridge, and on the dorsal surface there are two lines of pores. The parietal muscles start under the longitudinal ridge. The operculum has a dark mark in the proximal part (fig. 8), and there are 20–22 tentacles. There are radicles attached to the side of the zoœcium, with the attachment elongate in the direction of the long axis. None of the ovaria seen in sections are surrounded by the follicular cells occurring in nearly all species. The ovarium (fig. 10), with many ovarian cells, is found near the basal wall, a short distance below the ovicell. The ovum is seen in the upper part of the zoœcium, where there are strong muscles ready to force it into the ovicell from below internally, and sometimes there is an embryo or ovum in the ovicell as well as a large ovum below in the zoœcium. Levinsen * considers that in some species of Bryozoa the ovum comes out of the zoœcium and then enters the ovicell, but until proof is brought forward we may hold a position of doubt, as the contrary is known in so many cases.

All the characters given by Norman for his genus *Halysis* apply to *Catenaria lafontii* Aud., and it is not clear that a new genus is required. Levinsen makes the absence of the avicularia and of ovicells a reason for separating this species from his genus *Savignyella* = *C. lafontii* Aud., but in a large proportion of genera there is sometimes an avicularium, sometimes none. The genus *Catenaria* was discussed in my Report on the Sudanese Bryozoa †.

* *Loc. cit.* p 67.

† Journ. Linn. Soc., Zool. vol. xxxi. pp. 130, 131 (1909).

Loc. Madeira (*B.*); St. Paul's Rocks, N. Atlantic (*Challenger*), shallow water. Ras Osowamembe, Zanzibar Channel, 10 fath. (504); Prison Island, Zanzibar, 8 fath. (505), collected by Crossland.

Catenicellidæ.

In the Catenicellidæ the ovicells are of much more use in classification than has been generally recognised, but Levinsen has ignored them in his synopsis of the genera, nor has he used the shape of the opercula.

Based upon the form of the ovicells, there are two main divisions:—

First, those in which the ovicell is a terminal gonœcium, as *Scuticella* Lev., *Costaticella* * Maplestone, *Cribricella* † Lev., all three of which have an operculum with a straight or but slightly curved edge, and *Calpidium*, which has a sinus. In all these genera the ovicelligerous zoœcium has a much wider operculum than the ordinary zoœcium, but the proximal edge is straight, although in both the gonœcium of all of these, and the ordinary zoœcium of the first three, there may be an apparent sinus in the calcareous wall.

Second, those in which the ovicell occurs in a node with other zoœcia; divided into

I. Species with the ovicell occurring between two zoœcia in a straight line and the operculum straight or nearly so on the proximal edge; and here we have *Vittaticella* ‡ Maplestone, in which the ovicell is partly imbedded in the superior zoœcium and is surrounded by a beaded structure; also *Catenicella delicatula* Wilson and *Clariporella pulchra* MacG. have the ovicell in the same position but perforated all over. Perhaps a new genus is required for these two, and *C. umbonata* § B. may have to be included.

II. Species with the tuberculate imperforate ovicell at the end of a mother zoœcium of a biglobulus, namely, *C. perforata* B., *C. taurina* B., *C. cornuta* B., but very few ovicells have been seen in this group, and perhaps it is a matter of secondary importance whether they are on a biglobulus or a triglobulus.

III. Species with the ovicell belonging to the mother zoœcium of a triglobulus, including *Pterocella* Lev., which has a double area to the ovicell and the ovicelligerous aperture different from those of the ordinary zoœcia; *Strongylopora* ‖ Maplestone, with a perforated ovicell and the operculum straight at the proximal edge

* "Further Desc. of the Tert. Polyzoa of Victoria," Proc. Roy. Soc. Vict. vol. xii. n. s. p. 9 (1899). Levinsen, in making the genus *Costicella*, evidently overlooked the fact that Maplestone had already made a genus *Costaticella*, of which the type was *lineata*, a species included by Levinsen in his *Costicella*.

† As indicated in the 'Zoological Record,' the name *Cribricella* has already been used by Canu for a fossil belonging to the family Adeonidæ.

‡ The surface of none of the *Vittaticella* seem to be perforate, but smooth or papillose, but some have wrongly been described as perforate.

§ Described as *fusca* by MacGillivray.

‖ This Levinsen calls *Hincksiella*, but Maplestone has priority, as his genus was described in 1899 (Proc. Roy. Soc. Vict. vol. xii. p. 4).

of both the ordinary zoœcia and the ovicelligerous zoœcia, although the notch in the calcareous wall has been taken for an oral sinus; *Claviporella* Lev., with a perforated ovicell and triangular aperture to both forms of zoœcia.

The characters relied upon by Levinsen are none of them now mentioned, as my object is to show the importance of the ovicell and of the operculum in classification, though of course all available characters must be used.

Levinsen (p. 254, pl. xiii.) mentions a closure in *Vittaticella* and other genera which he calls an "occlusion." I have not seen anything quite like Levinsen's description, in which it is said to start from three processes, which, of course, is the youngest stage, but in a specimen of *Catenicella cornuta* B. from Western Port, Victoria, there is in the older zoœcia a calcareous closure which is, however, under the operculum and quite independent of it. There are two round openings near the distal end, that is, one at each side, and a rather larger one at the proximal end. In a few very old zoœcia these two distal pores coalesce and the proximal opening becomes much larger, as if it were being dissolved away. I have only been able to find this closure in *C. elegans*, in var. *zanzibariensis*, nov., and in *C. cornuta* as mentioned, although I have looked through the Catenicellidæ in my collection and the British Museum, though Levinsen gives it as a character of *Vittaticella* (*Catenaria* Lev.). However, it only occurs in the older and empty zoœcia, and now, knowing this, I might on re-examination find some which had been overlooked. On p. 505 it is suggested that certain closures of Meliceritidæ should be compared.

Vittaticella elegans Busk. (Pl. LXV. figs. 1–7, 12.)

Catenicella elegans Busk, Brit. Mus. Cat. Mar. Polyzoa, p. 10, pl. ix. (1852); Zool. Chall. Exp., Polyzoa, vol. x. pt. xxx. p. 12 (*pars*); Ortmann, "Die Japanische Bry.," Arch. für Naturgesch. vol. i. p. 27 (1890); MacGillivray, Prod. Nat. Hist. Vict. dec. iii. p. 23, pl. xxiv. fig. 10 (1895); Thornely, Ceylon Pearl-Oyster Fisheries, Suppl. Rep. xxvi. p. 109 (1905).

Vittaticella elegans Maplestone, "On a new name—*Vittaticella*—for the Polyzoan genus *Caloporella* McG.," Proc. Roy. Soc. Vict. vol. xiii. n. s. p. 203 (1900).

Specimens from Zanzibar growing on seaweed seem to be this species. There is sometimes on one side of the zoœcium a very long, raised avicularium with the mandible directed distally (figs. 1, 2). A similar avicularium occurs in a specimen in the British Museum from Arafura Sea. On the dorsal surface there are the two small dots as figured by me in *Vittaticella contei* Aud. (also in *Brettia*), and the radicles are in the same position as in *V. contei*. In one case a new zoœcium springs from the anterior surface of an older zoœcium, and this I have seen in other species of *Vittaticella*.

The operculum is larger than that of *V. contei*, and is more

curved on the proximal edge; on the other hand, it is not so large as that of *V. buskei* W. Th. These are all nearly related, but the difference in the operculum and the number of tentacles, besides other characters, indicate that they must be separated.

There are often many ovicelligerous zoœcia in one node. In one specimen there are two cases of a node having six ovicelligerous zoœcia in one continuous line, and in both cases a lateral zoœcium grows from the side of the unjointed node. In the ovicelligerous zoœcia the avicularia near the oral aperture are directed forwards instead of laterally, as in the other zoœcia. In the Tertiary beds of Curdies Creek, Australia, there is a form with long biserial nodes which I described as *Catenicella internodia**, but for which MacGillivray has since made the genus *Ditaxipora*; also from the North Italian tertiaries I have described two forms with long biserial nodes as *C. septentrionalis*† and *C. continua*, of which *continua* is probably *Vittaticella*, but *septentrionalis* will require a new genus, so far as we can see at present.

Among recent forms no long nodes have previously been described, but in the specimen from Madeira, which Norman considered to be *C. contei* Aud., there are two zoœcia with ovicells following one another in an internode. Long ovicelligerous nodes are also found in *Catenaria diaphana* B. (see p. 482).

The ovaria commence at the proximal end at one side, whereas the testes are near the distal end to one side. There are ciliated embryos in the ovicells, and below the ovicells there are several fleshy bands or tubes by which, no doubt, material for growth is transferred to the ovicell.

Loc. Bass's Strait, 47 fath., Banks' Peninsula, Algoa Bay, Port Dalrymple; Tasmania (*B.*), Victoria (*MacG.*); Sagamibai, Japan (*Ort.*); Gulf of Manaar, on floating oyster-cages (*Th.*); Arafura Bay (*Brit. Mus.*). Prison Island, Zanzibar shore (503); Ras Osowamembe, Zanzibar Channel, 10 fath. (504), collected by Crossland.

Vittaticella elegans, var. zanzibariensis, nov. (Pl. LXV. figs. 8–11.)

Zoarium about 40 mm. high, with the branches curved over. Zoœcia elongate ovoid, surface smooth or slightly papillose; large lateral avicularia with a large pore at the base, in this respect differing from the type. There are on the dorsal surface near the distal end, and often resting on the large avicularia, two minute oval avicularia or an oval raised tubular opening. The radicles arising from the dorsal surface form a thick bundle.

No ovicells are known.

It is very similar to *V. elegans* B., but the larger beaked

* "Foss. Chil. Bry. from S.W. Victoria," Quart. Journ. Geol. Soc. vol. xxxvii. p. 318, pl. xvi. figs. 78, 79 (1881).

† "North Italian Bryozoa," Quart. Journ. Geol. Soc. vol. xlvii. p. 5, pl. i. figs. 1–8 (1891).

avicularium with the large pore at the base and the minute dorsal avicularia suggest its being separated as a variety.

The structure of the vittæ has not received much attention, though Harmer* has alluded to it; but in this species it has been possible to obtain some explanation. The vittæ are sunken perforated grooves in the calcareous wall, and along each groove there is a cylindrical tube, and within this, from the pore-tubes (the perforations just mentioned), organic cords spread out and reach the upper free surface at definite spots or pores (fig. 10). It thus seems that the vittæ should be compared with pore-chambers of many Cheilostomata in so far as there is indirect communication from the interior to the water-surface, through the vittæ.

Loc. Prison Island, Zanzibar Channel, 8 fath. (505); Wasin, Brit. East Africa, 10 fath. (500), collected by Crossland. Algoa Bay and Natal (*Brit. Mus.*).

Membranipora savartii Audouin. (Pl. LXXI. figs. 1–4.)

In my Report on the Bryozoa from the Red Sea (Journ. Linn. Soc., Zool. vol. xxxi. p. 138), I refer to the astonishing amount of anastomosing protoplasmic threads in a specimen from Zanzibar, and as some from the Sudan are also very full, this seems to be a specific character. It certainly seems strange to find such an extraordinary quantity, for though in my collection there are preparations of a large number of species showing the threads exceedingly well, I have never seen anything approaching these, and further study of the funicular cords is desirable.

These threads are very abundant in zoœcia with active polypides having digestion in full activity. In these threads are included small granular patches, either round or filiform, and where the polypides have degenerated or are degenerating there are large masses of this granular substance also surrounded by and connected with the protoplasma (fig. 2). In earlier stages the protoplasmic threads are in some cases surrounding the granular cord (fig. 4); in others there are only one or two plasmic threads by the sides of the granular cord or mass.

The collecting together of these masses naturally suggests that waste products are thus brought together and afterwards got rid of.

Loc. Zanzibar Channel from the under side of buoy (528); Ras Osowamembe, Zanzibar Channel, 10 fath. (504); Prison Island, Zanzibar Channel, 8 fath. (505), collected by Crossland.

?Membranipora armata Haswell (*non* Koschinsky). (Pl. LXVII. fig. 10, & Pl. LXXI. figs. 5–10.)

Biflustra armata Haswell, "On some Polyzoa from the Queensland Coast," Proc. Linn. Soc. N. S. Wales, vol. v. p. 38, pl. i. fig. 7 (1880).

* "Morph. Cheil.," Quart. Journ. Micr. Sc. vol. xlvi. p. 306 (1902).

Membranipora panhoplites Ortmann, "Die Japan. Bry.," Arch. Naturgesch. vol. i. p. 28, pl. ii. fig. 4 (1890).

Membranipora armata Waters, "On Membraniporidæ," Journ. Linn. Soc., Zool. vol. xxvi. p. 687, pl. xlvii. fig. 3 (1898).

The specimen from Wasin is in parts in the hemescharan stage, in others in the bilaminate, and one in my collection from Port Molle is also bilaminate. This specimen from Wasin starts from a unilaminate incrusting layer, but in places the zoarium is tubular.

The distal wall of the zoœcium is slightly prominent, somewhat reminding us of what Busk calls the penthouse projection in *Aspidostoma giganteum* B. There are no ovicells in any of the specimens examined, and on most of the zoœcia an avicularium occurs on one side only, at the distal end, directed proximally, while on the other side, in a long chamber, there is a long gland with distinct secreting cells (figs. 8, 9), but usually without any lumen. These glands are irregular in shape, sometimes lobed, and there may be two elongate lobes side by side. In all the specimens seen there is a distinct calcareous bar or arch to the avicularium, and there are two openings on the front of the avicularium, though sometimes the lateral projections in the avicularium do not meet, when there is, consequently, only one opening (fig. 7). In the membrane covering the avicularian chamber there is, under the mandible, a chitinous ring where the peculiar body* ends (fig. 9, *pb.*), and there are other species of Cheilostomata with a chitinous ring or other thickening. As we have seen, there is at one side an extremely long avicularian chamber, at the proximal end of which there are stout muscles (fig. 9 *a*) attached to a very long tendon by which the mandible is closed; further up there are muscles also on both sides of the chamber, but much more delicate than the last (fig. 9 *b*), and attached to a shorter tendon fastened to the base of the mandible with a median attachment, whereas in some species of Cheilostomata this muscle is attached at each side.

The chamber containing the glands (fig. 9, *gc.*) is also very long, and may be close to the avicularian chamber of the zoœcium next above or below, but no connection with the avicularia has been found after careful examination of many microtome sections. On the inside there are pores like rosette-plates, and the protoplasmic threads from these are sometimes seen passing to the gland, but no other internal opening has been found. Externally there are three or four minute pores along the line of junction of the zoœcia, which, however, were only noticed when carefully searching for openings. There are similar small pores over the avicularian chamber. We have here another Bryozoan puzzle, for the gland is not the same as the oral gland, and is contained in a calcareous chamber without any openings except small pores.

* This peculiar body is in many Cheilostomata contained in a sheath, homologous with the tentacular sheath, but in this species no sheath was found.

The operculum is membranous, with a diagonal band or sclerite on each side to which the muscle for closing the operculum is attached; but also attached to the same sclerite there is a muscular band fastened to the tentacular sheath. I have not noticed a double attachment like this before, but examination may show that it occurs in other species.

In a large proportion of zoœcia there are two polypides of about the same size, so that 20–30 zoœcia with two polypides may be seen adjoining one another, whereas other pieces may show a much more limited number of double polypides. Although budding polypides in the same zoœcia as mature polypides are known to us all, and have been described by Haddon*, Ostromoff†, and Harmer‡, they are only in a limited number of zoœcia; nor have I been able to see that they are the same as the two zoœcia described by Prouho § in *Alcyonidium duplex* P. The two tentacular sheaths are side by side, and are attached to the operculum and the neighbouring wall. No ovaria or ova have been seen, and only in a very few cases were testes found occurring in round masses near the lateral wall.

From the lateral walls there are bundles of muscles (6–12) attached to the frontal membrane of the zoœcia.

In all the lateral walls there are pores at fairly regular intervals all over the walls, and besides there are in some cases disks with numerous pores near the opercular wall. Further, in a bilaminate piece of *M. armata*, there are in several cases large perforated disks on the basal walls, like those described in *Petralia* for the radicle attachment, though, strangely, in the unilaminate parts no distinct perforated disks have been found. This form cannot remain under *Membranipora*, though I am not suggesting that it is *Petralia*, but call attention to various similar characters in forms placed far asunder.

There are about 30 tentacles, which is a larger number than has been found in any true *Membranipora*. *Membranipora nigrans* Hincks and *M. marginella* H., with avicularia similarly placed near the distal end, have also curious large vicarious avicularia.

Loc. Port Denison, Holborn Island, 20 fath. (*Haswell*); Port Molle, Australia; Sagamibai, Japan, 40 fath. (*Ortmann*). Wasin, Brit. East Africa, 10 fath. (500); Zanzibar Channel, from underside of buoy (528), collected by Crossland.

MEMBRANIPORA CATENULARIA Jameson.

For synonyms see Miss Jelly's Catalogue.

Although the Arctic *M. monostachys* Busk from Franz Josef Land has many points of similarity, the operculum in *M. catenularia* from Zanzibar is only about half the width of that of the

* Quart. Journ. Micr. Sc. vol. xxiii. p. 520 (1883).
† Arch. Slaves de Biol. vol. ii. p. 341 (1886).
‡ "Excretory Processes in Marine Polyzoa," Quart. Journ. Micr. Sc. p. 139 (1891).
§ "Cont. à l'hist. des Bry.," Arch. de Zool. Expér. et Gen. 2nd ser. vol. x. p. 581 (1892).

former species, and does not reach to the border of the opesium, so that they can be distinguished by this character.

Loc. Widely distributed, but there is much uncertainty about some of the determinations. Chuaka, Zanzibar, 3 fath. (506), 2 fath. (508), on the dorsal surface of *Steganoporella magnilabris* B., collected by Crossland.

FARCIMIA OCULATA Busk. (Pl. LXVII. figs. 8, 9.)

For synonyms see :—

Farcimia oculata Waters, "Rep. on the Mar. Biol. of the Sudanese Red Sea, Bryozoa," Journ. Linn. Soc., Zool. vol. xxxi. p. 167 (1909); and add Canu, "Bry. des Terrains Tert. des Env. de Paris," Ann. de Paléont. vol. ii. p. 20, pl. ii. figs. 36, 37 (1907); "Bry. Helv. de l'Égypte," Mem. à l'Inst. Égyptien, vol. vi. p. 191, pl. x. figs. 16–19 (1912).

Nellia tenella Levinsen, Morph. & Syst. Studies of the Cheil. Bry. p. 120, pl. i. figs. 13*a*–13*e* (1909).

The growth is from a spreading stolon from which, at intervals, sub-colonies grow (figs. 8, 9), commencing with short calcareous nodes joined by chitinous tubes. There are usually three or four nodes in the stalk, though there may be only one. Quite similarly sub-colonies on a stalk with internodes grow from delicate stolons in *Chlidonia cordieri* Aud., *Diplodidymia complicata* Reuss (Pl. LXVII. figs. 11, 12), *Catenaria parasitica* Busk *. I figured it some years ago for *Chlidonia cordieri* Aud. †, and since then Calvet and Levinsen have dealt with the species. All these species have a somewhat similar operculum, about the same size, and the number of tentacles in all is 11–12. They are probably more nearly related than we have imagined.

There are two very thick chitinous tubes connecting each new branch.

The ovarium, with several ovarian cells, often in a row, is near to the inner wall, about equidistant from the distal and proximal ends. One ovum grows extremely large, and is pressed into all kinds of shapes through want of room. The ovum passes into a sac near the basal wall and the distal end, and before an ovum has passed into it muscle-threads are seen radiating over this sac.

Levinsen has figured the ovicell, which is a small cap-like growth, and this I have seen in a few cases, but often in zoœcia with ovicelligerous zoœcia no external difference is recognised. There is, however, often a vertical division separating the ovicellular wall from the rest of the zoœcium.

The triangular mandible of the avicularium is found with difficulty and is extremely minute, being about 0·006 mm., while a large number of the mandibles, such, for example, as in *Retepora cellulosa*, are 35 times as long; some, as for example in *Lepralia*

* The Honourable Mary Palk informs me that *Catenaria lafontii* Aud., grows on a similar stalk.

† Journ. Linn. Soc., Zool. vol. xxvi. pl. i. fig. 8 (1896).

occlusa B., are 60 times as long. In many cases there seems to be no mandible, only a disk, to which the peculiar body is attached, and this peculiar body is relatively very large. Smitt refers to the mandible of the Floridan specimens often being wanting, "presenting the opening closed only by a membrane."

There is no possibility of knowing what the *Cellaria tenella* of Lamarck was, and it certainly may have been *Cellaria* *, so that, as I have previously said, it is better to retain the name *oculata*. The genus *Nellia* was not satisfactorily described, and therefore various authors have adopted the genus *Farcimia* of Pourtales and Smitt. Fleming had made a genus *Farcimia* which might include *Nellia*, but as he made it for *Cellaria*, with *C. fistulosa* as type, it was always a superfluous genus, and Smitt considered it non-existent. Although Levinsen adopts *Nellia*, it seems better to adhere to *Farcimia*, the name used in my recent papers, and which has been used by most workers recently.

Loc. See my paper referred to, and add Wasin, Brit. East Africa, 10 fath. (501); Prison Island, Zanzibar Channel, shore (503), 10 fath. (505); Ras Osowamembe, Zanzibar Channel, 10 fath. (504); Meweni Bay, Zanzibar, 6 fath. (510); Chuaka, Zanzibar, 3 fath. (526), collected by Crossland. Texas and St. Thomas, W. Indies (*Levinsen*).

Diplodidymia complicata Reuss. (Pl. LXVII. figs. 11–15, & text-fig. 79.)

Diplodidymia complicata Reuss, "Foss. Fauna der Oligoc. von Gaas," Sitzungsber. d. k. Ak. der Wissensch. Wien, math.-nat. Cl. vol. lix. Abth. i. p. 469, pl. iii. figs. 6–9 (1869).

Micropora ratoniensis Waters, Ann. Mag. Nat. Hist. ser. 5, vol. xx. p. 185, pl. iv. fig. 5 (1887).

Micropora articulata Waters, Quart. Journ. Geol. Soc. vol. xlvii. p. 14, pl. ii. figs. 5, 6 (1891).

From Chuaka, Zanzibar, there are several pieces throwing light on this form, which has only been seen in fragments previously.

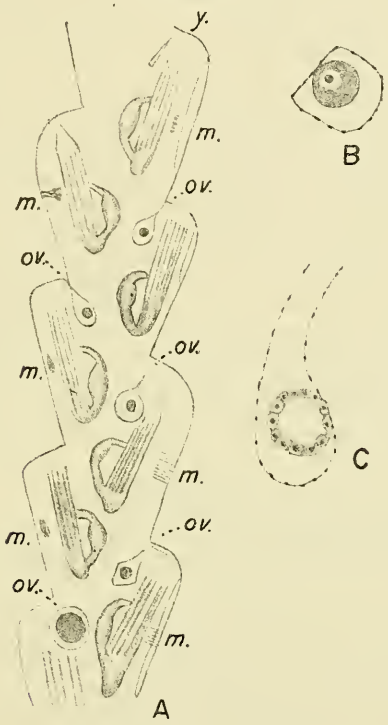
The zoarium has a stalk consisting of long barren internodes, sometimes as many as eight, followed by long articulated internodes with the zoœcia placed diagonally on the four sides. The contents of the barren internodes send out a branch to the surface, just as we have seen in *Chlidonia cordieri* Aud. From near the starting-point of each sub-colony a number of narrow radicles radiate, and sometimes from one of these radicles a fresh sub-colony grows, as is frequently the case in species with creeping stolons.

The branches are dichotomous and articulated, having two chitinous tubes forming each articulation. Occasionally there are more than the four rows, but this will only be for a short distance near the articulation, and in one piece there is a median

* Busk gives it with ? synonym of *Cellaria gracilis* Busk.

line on the dorsal surface with the zoœcia on each side. The front wall has a minute pore on each side below the oral aperture (fig. 13), but these are only seen in Eau de Javelle preparations, and in the same way the long slit-like pore on the one side is scarcely seen so long as the membrane covers the walls. The muscles passing through this slit are wide, and are attached to a

Text-fig. 79.



Diplodidymia complicata Reuss.

A. Showing small sacs hanging from the opercular region, and in each an ovum grows (*ov.*). At *y.* there seems as yet no ovum in the small sac; *m.*, the muscles of the opesium. × 50.

B. Section showing an ovum in the small sac. × 250.

C. Section in which the ovum has segmented and a blastula is formed. × 250.

chitinous thickening or sclerite on the front membrane, and are partly protected by a calcareous wall. There are two rosette-plates in the entire lateral wall. On the avicularian chamber there is a concave pit with a central perforation, no doubt indicating that radicles can be given off from this pit, and thereby

the two pores described in the fossil *Micropora articulata* Waters are explained, the one being the avicularian and the other the radicular opening. The avicularium is by the side of the aperture, and the mandible is triangular.

There are 11–12 tentacles.

The testes extend all down the lateral wall. A very few small ovaria with one to three small ovarian cells were found.

A small ovum is found in a small sac hanging from the opercular region (text-fig. 79). The sac and ovum grow until ultimately the embryo nearly fills the zoœcium, and now there are small muscles from the opercular wall to the ovicell and a strong lateral band. There is no external indication of any ovicell nor of which cells contain an embryo. The embryo is relatively large, with the couronne very large and distinct, and the way in which the embryo grows in the pendant sac may throw light upon the development of the ovum and embryo in *Adeonella*, but no stage has been found with a sac hanging from the opercular region in *Adeonella*.

The present species, as I have previously indicated, is closely allied to the fossil *Cellularia diplodidymoides* Meun. & Pergens from the Chalk, and both belong to the same genus *. Canu has described four fossil species from the Paris Basin, but, unfortunately, he has not given figures as well as photographs. In the work there are a number of magnificent photographs, showing the characters most beautifully, but some of the Paris authorities are making too hard and fast a line that everything must be photographed. The specimens in question (pl. v. figs. 6–10) do not lend themselves to photography, and require either figures or full description for elucidation.

These Zanzibar specimens are so different in the younger and older joints that with fossils several species might be made from one colony.

Canu † says that the genus *Diplodidymia* is the *Poricellaria* of d'Orbigny, but the description of this latter leaves recognition impossible without direct comparison, and therefore Canu is quite right in retaining the name *Diplodidymia* Reuss.

Loc. Off Katow, New Guinea, 7 fath.; Singapore (fide *Whitelegge*, in lit.). Chuaka, Zanzibar, 3 fath. (506), collected by Crossland.

Fossil. Gass, near Dax, S. France, Oligocene; Montecchio Maggiore, N. Italy, Bartonian.

Chlidonia cordieri Audouin. (Pl. LXV. figs. 15, 16.)

Eucratea cordieri Aud. Descrip. de l'Égypte, Hist. nat. p. 242, 2nd ed. p. 74; Savigny's pl. xiii. fig. 3.

Chlidonia cordieri Waters, Journ. Linn. Soc., Zool. vol. xxvi.

* "Bryozoaires du Système Montien," Louvain, p. 3, pl. ii. fig. 3 (1886).

† "Bryozoaires des Terrains Tertiaires des Environs de Paris," Ann. de Paléont. t. ii.–v. p. 39 (1907).

p. 18, pl. i. figs. 8, 9 (1896), which see for synonyms, and add: Calvet, "Bry. Mar. de Cette," Trav. de l'Inst. de Zool. de l'Univ. de Montpellier, ser. 2, mem. 11, p. 13, pl. i. figs. 1, 2 (1902); "Bry. Mar. des Côtes de Corse," op. cit. mem. 12, p. 6 (1902); Levinsen, Morph. & Syst. Studies on the Cheil. Bry. p. 197, pl. viii. figs. 6 *a*–6 *y* (1909).

From the front wall to the zoœcial wall, through what has been called a second chamber, but is the equivalent of a compensation sac, there is a bundle of three, four, or more muscles (see fig. 15). The attachment of these on the front has been mistaken for a suboral pore, and in dried specimens there is frequently an opening here.

No ova or ovaria have been found in any of my sections, whereas some show an embryo about half filling the zoœcium, though no external difference has been noticed.

The operculum is interesting, as it has at each side a projection or wing at right angles to the operculum (figs. 15, 16); also at each distal corner there is a slight projection. The wing reminds us somewhat of the thin membranous growth of many Membraniporæ and some Microporæ.

There are 9–11 tentacles.

Loc. Red Sea (*Aud.*); Naples, Trieste, Rapallo, Nice, Cette, Corsica, Algiers, Tunis, Tyre, Calvados, Egypt. Victoria (Australia), Cape York, New Zealand, Atlantic (fide *Carus*); Canaries (*d'Orb.*). Wasin, Brit. East Africa, 10 fath. (500), on calcareous seaweed, collected by Crossland.

Cellaria.

Levinsen, following Norman, uses *Cellularia* for what we understand as *Cellaria*, but as these names have long been used for widely distinct genera I must certainly, in the most definite manner, refuse to use the name *Cellularia* for what we have for many years understood as *Cellaria*.

Cellularia of Pallas was a simply ridiculous jumble of forms for which a place had not been found elsewhere. The species mentioned by him are now placed in nine genera, one of which is the Cyclostome *Crisia*, and as the description of the genus refers to the ovicell of *Crisia*, perhaps the least objectionable thing would have been to have retained the name *Cellularia* for *Crisia*. The real difficulty, however, is that the name *Cellularia* has been retained for a quite different group, and to interchange and now use a name long understood in a different sense would cause the greatest confusion.

Solander employed the name *Cellaria* for a group approximately, but not absolutely, similar to the *Cellularia* of Pallas, giving a definition also not quite the same, and it has been considered to be only a change of spelling, though curiously, Ellis & Solander never indicate that they considered it was the same as *Cellularia* of Pallas, nor throughout the description of the genus

do they ever refer to Pallas, although many of the species dealt with had been mentioned by that author. This is certainly difficult to understand, and perhaps would have been different if Solander had lived to complete the work himself.

Hincks considered that the species in Solander's genus had all found places elsewhere, and that the genus of Solander had lapsed. He therefore took *Cellaria* as the genus of Lamouroux, who under *Cellaria* put *Cellaria* (as now understood) with the type *C. salicornia* and also *Tubucellaria*. Lamouroux says of all genera none seems to contain as widely distinct species as this, and that it seems to have been formed to contain everything that could not be placed under *Flustra* or *Sertularia*.

Instead of dropping *Cellularia* as hopeless, Busk unfortunately retained it for a small division, and this has been accepted.

The first species mentioned by Pallas in his genus is *tubucellaria*, which also is included in Lamouroux's *Cellaria*, though not as the type, which was *Cellaria salicornia*; and Stoliczka *, in a long discussion of the subject, took the view that as *tubucellaria* was first mentioned the genus must be called *Cellaria*, and *Cellaria*, as now understood, must be separated as *Salicornia*.

We now see that it is unfortunate that Hincks should have retained *Cellaria*, though it then appeared that this would not be challenged, and it has been adopted generally, and no genus seemed more firmly established. However, it is now clear that if Hincks had continued to use *Salicornaria* there would have been no possibility of the name of a now long recognised genus being replaced by one used in most various ways, and now limited to another small group.

Those who are at work upon the class know how often the descriptions of the earlier authors are now meaningless, for the characters then used are found to be useless; but this can hardly be appreciated by those who have not had occasion to consult such descriptions. It is as if some well known tree had generations ago received a name and a few lines of description which would apply to a quarter of our phanerogams and some cryptogams.

I have previously shown that we are brought into a perfectly ridiculous position by being asked to adopt such names at all costs, when we often have no idea what they meant. It is not science, and since *Cellaria* as modified by Hincks is well established I shall still use it †.

* Foss. Bry. aus dem tert. Grünsand. der Orakei Bay bei Auckland, pp. 142–149 (1864).

† Norman ("Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. p. 293 (1909)) challenges the correctness of considering that *Tubucellaria opuntioides* should have been considered the type of *Cellularia*, but I cannot agree with his conclusions as to what I say being contrary to the British Association Rules of Nomenclature. My edition is later than Norman's, but apparently is only a reprint, and it says "When they omit doing so" (*i. e.* fixing a type), "it may still in many cases be correctly inferred that the first species mentioned on their list, if found accurately to agree with their definition, was regarded by them as the type." This rule of course means that if the generic diagnosis is taken from some one species, and that an error has been made in including the first, then common sense may be

Cellaria gracilis, var. tessellata, nov. (Pl. LXVII. fig. 7.)

For synonyms of *Cellaria gracilis* see Miss Jelly's Catalogue and add:—

Meissner, "Liste der von Herren Prof. Simon bei Amboina und Thursday Island ges. Bry.," Jena Denkschr. vol. viii. p. 730.

A specimen from Ras Osowamembe growing on Hydrozoa seems to be a variety of *C. gracilis*. In this specimen the trabeculæ mentioned by Busk enclose an area formed of large tessellated divisions, about 20 (fig. 7); and curiously, another species, which I call *C. wasinensis*, sp. n., has also a tessellated area, but the avicularium of that species is triangular with an acute mandible, and belongs to the *C. tenuirostris* group. These large tessellated areas are unusual, and have not been found in various species of *Cellaria* in my collection; nor in the British Museum 'Challenger' collections are they found in *C. bicornis* B., *C. dubia* B., *C. malvinensis* B., *C. variabilis* B., *C. divaricata* B., *C. australis* Hincks, *C. rigida* MacG. The significance both of the trabeculæ and of the divisions is at present obscure.

The opercula are a trifle larger than the type from Holborn Island, but the mandibles are the same.

Loc. Type: Cumberland Island; Cape Capricorn; Victoria, 8 fath.; Torres Straits; Holborn Island (Queensland); Katow, New Guinea, 7 fath. Variety: Ras Osowamembe, Zanzibar Channel, 10 fath. (504), collected by Crossland.

Cellaria wasinensis, sp. n. (Pl. LXVII. figs. 1–6.)

Zoarium about 25 mm. high, with small branches dichotomously jointed and connected by two or three stout straight chitinous tubes and a "knot." The zoarium swells out where the ovicells occur, as is frequently the case in *Cellaria*, there being sometimes two such swellings in an internode; and it will be seen on fig. 6 how these are equidistant from the joint in the two branches.

The zoœcia are rather elongate, hexagonal, or rhombic, with the lateral walls of the zoœcium much raised, surface finely granular; oral orifice wide, with two teeth on the distal edge, which is slightly turned up, forming a lip.

The ovicellular aperture is large, round, with a plate from the proximal border spreading out and partially closing the aperture.

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used in saying the first is not the type, but surely it never meant that any individual could subsequently pick and choose which was the type among those agreeing equally well. However, in my work, to which Norman refers, I and other specialists were under an obligation to follow the rules of the Zoological Congress, and the rule in question is "other things being equal the name is to be preferred which stands first in the book or article." In anything I write now the same obligation does not exist, though the rule entirely commends itself, and it does not seem to clash with the rules previously mentioned, drawn up by Strickland. Both practically say that when there are adequate reasons to indicate which was the type intended, that may be considered the type although not first mentioned, but without good cause to the contrary the first is the type, and independently this is what workers are constantly doing.

The ovicellular opening of *C. gracilis* Busk, var., *C. australis* MacG., *C. rigida* MacG., and *C. hirsuta* MacG., is similar; but in the few cases where the ovicellular aperture is mentioned, it is often only the incompleted opening in an early stage which is described.

The avicularia are triangular with mandibles like those of *C. tenuirostris* B. In the avicularium the calcareous submandibular wall rises up to the proximal edge of the mandible with a notch on each side, perhaps for the muscles (fig. 5), so that the submandibular part of the avicularium is almost entirely closed; and this is an interesting point, for Levinsen considers that the Meliceritidæ differ from the living Cheilostomata in having the submandibular portion entirely calcified.

As I have mentioned *, there is, however, a specimen in the Museum d'histoire naturelle in Paris from the Bancs des Aiguilles, S. Africa, which is probably the *Macropora cribrilifera* Maplestone †, fossil from Mitchell River, in which the large vicarious avicularia have the submandibular part entirely calcified. Maplestone mentions that three of the zoœcia have a "calcareous closure." I have previously stated that there seem to me to be some points of relationship between *Cellaria* and Meliceritidæ.

Levinsen deals but very shortly with the avicularia of *Cellaria*, and I am not quite sure that I follow what he means about the avicularium of *C. malvinensis*. He, however, says that the submandibular cryptocyst reaches up to the operculum in *C. fistulosa*. I have not seen it rise as it does in *C. wasinensis* in any of my specimens of *C. fistulosa* L., but there is a similar wall rising to the base of the mandible in *C. variabilis* B., *C. hirsuta* MacG., and *C. gracilis* B.; *C. variabilis* has two slits in the submandibular part. More frequently there is an open rounded submandibular space as in *C. dennanti* MacG.‡, *C. malvinensis* B.‡, *C. australis* H., *C. fistulosa*, *C. tenuirostris* Busk, and *C. wandeli* Calvet. In *C. fistulosa* this is not much more than a wide round sinus.

There are two species which have been taken for *C. malvinensis* B. The first, which I have from Wanganui, New Zealand, has a fairly large submandibular space with a distinct ridge where the proximal end of the mandible comes, in fact in a few cases this is continued, forming a bridge across. The mandible soon contracts, with the distal end lanceolate. The other form is slightly smaller, from Baie Orange, S. Africa, and mentioned by Jullien as *C. malvinensis*. It has the sides of the zoœcia straight, the distal end rounded, and the submandibular part of the avicularium rises up to the mandible, having two diagonal slits. The mandible is shorter than in the other species, sloping gradually to the apex. Whenever this is figured it might be called *C. jullieni*. The

* Résultats du Voyage du S.Y. Belgica, "Bryozoa," p. 35 (1904).

† "Further Desc. of the Tert. Poly. of Victoria," Proc. Roy. Soc. Vict. vol. xiii. n. s., p. 204, pl. xxiv. fig. 2 (1901).

‡ Rés. du Voy. du S.Y. Belgica, pl. ii. fig. 9 *a* & pl. viii. figs. 4, 5.

forms from Curdies Creek which I considered to be *malvinensis* have since been separated by MacGillivray as *C. contigua*, but the fossils from Bairnsdale and New Zealand are *C. malvinensis*.

The operculum of *C. wasinensis* is nearly semicircular with large hollows fitting on to the teeth, and is similar to the operculum of *C. gracilis*. The trabeculæ (figs. 3, 4) enclose in the lower part large divisions, about 7 in number, and the divisional walls are very thick, whereas in *C. gracilis* var. *tessellata*, nov. (fig. 7), they are linear with numerous divisions.

There are about 13 tentacles. In *Cellaria* we find * the number of tentacles is approximately the same throughout the genus, only *C. dennanti* MacG., a species showing other differences, has 20. Now *Cellaria* is a well marked genus having opercula of a special form, with a hollow cup fitting on to the teeth in the oral aperture, and the ovicell has a characteristic chamber, and also a characteristic ovicellular aperture.

Levinsen † states that a zoœcium does not correspond with an area, but with this I cannot agree, as I find the superficial divisions approximately mark off the zoœcia, even though they may in parts extend somewhat under the divisional line, and this is the case in many genera.

The ovarium usually has two ova, though there may be one or three, and the ovum is large when it enters the ovicell.

Loc. Wasin, Brit. East Africa (501) (507), 10 fath.; Ras Osowamembe, 10 fath. (504); Prison Island, Zanzibar Channel (505), 8 fath.

Cellaria tenuirostris B., *C. salicornioides* Aud., *C. magnifica* B., *C. malvinensis* B., *C. gracilis* B., have been previously described from tropical regions.

THAIROPORA MAMILLARIS Lamouroux.

Flustra mamillaris Lamouroux, "Polyp. corall. flexibles," p. 110 (1816) and add to Miss Jelly's synonyms :—

Thairopora mamillaris MacG. Prod. Zool. Vict. dec. xx. p. 351, pl. 196, fig. 2 (1890).

Membranipora mamillaris Hincks, Ann. Mag. Nat. Hist. ser. 6, vol. viii. p. 91 (1891).

Thalamoporella mamillaris Levinsen, Morph. & Syst. Studies on Cheil. Bry. p. 194, pl. vi *a*. figs. 5 *a*–5 *e* (1909).

There is a small piece from Chuaka, Zanzibar, which was decalcified when received. It was preserved in $HgCl_2$, but no doubt there was acid as well. The main points could, however, be seen, and the opercula and mandibles were separated, and although the mandibles are smaller than in the specimen received from the Red Sea, to which reference is made below, yet they are quite characteristic of *T. mamillaris*. Levinsen has shown that there are calcareous spicules in all the Thalamoporellidæ, affording

* Résultats du Voyage du S.Y. Belgica, "Bryozoa," p. 37 (1904).
† Morph. & Syst. Studies on the Cheil. Bryozoa, p. 211.

good specific characters, and the way in which he has dealt with them is one of the most important features of his book.

Loc. Victoria (*MacG.*); South Australia (*my coll.*); a weed, brought up on the sounding-line in the Red Sea, covered with this species, was given to me by a passenger. We may take it that there is every probability of its being from the Red Sea, though we cannot record it as such without pointing out the possibility of its having remained on the line from some previous locality. Chuaka Bay, Zanzibar, 2 fath. (509), collected by Crossland.

Steganoporella magnilabris Busk. (Pl. LXXII. figs. 12–20.)

Membranipora magnilabris Busk, Brit. Mus. Cat. Mar. Polyzoa, p. 62, pl. lxv. fig. 4, in the explanation of the plate called *M. grandis*.

Steganoporella magnilabris Harmer, "Rev. of Gen. *Steganoporella*," Quart. Journ. Micr. Sci. vol. xliii. p. 279, pl. xii. fig. 10, pl. xiii. figs. 31, 44–46, which see for synonyms. Add Thornely, "Mar. Poly. of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 145.

Specimens from Wasin agree in most respects with the description of this species, though the mandibles of the A zoœcia having no teeth are more like those of *S. buskii* Harm. However, a comparison with the British Museum specimens has led to my leaving them under *magnilabris*, though some workers might * separate them as a variety. The zoaria are bilaminate, irregularly contorted, and evidently attain to a very considerable size, as some pieces, evidently only fragments of larger ones, measure two or three inches across.

There are very few B zoœcia, in fact two mounts, each containing about 300 zoœcia, had no B zoœcia. On examining all the remaining material a few scattered B zoœcia were found, and it is interesting to find that from these zoœcia, which are somewhat larger than most A zoœcia, two new zoœcia usually arise, that is the row here bifurcates, and to this but few exceptions were found in all the material examined.

I called attention to this duplication from the B zoœcia occurring in some fossils, but Harmer † has shown that it is by no means universally the case. At the time I wrote very little material was available for comparative study. It, however, is a fact that in many species two zoœcia usually, or at any rate frequently, grow from the distal end of B the zoœcia. In this species, when the operculum is removed, it is often not possible to be sure which are B zoœcia, as there are large A zoœcia, with a large shelf, in all respects similar excepting the operculum, so that with fossils there will often be uncertainty. In most other species there is a greater difference between the A and B zoœcia. The A opercula vary considerably in size. In a specimen from (508) the B zoœcia are much more common than in those from (500).

* "Bryozoa from Aldinga," Quart. Journ. Geol. Soc. vol. xli. p. 292.

† Revision of the genus *Steganoporella*, p. 266.

According to Harmer the A zoœcia are in most species of *Steganoporella* more abundant than the B, and he says there are no B in *S. simplex* H., and goes on to say that they are rare in *S. sulcata* H., *S. lateralis* H., and *S. magnilabris* B. In *S. truncata* H. the ratio of A to B is 4–5 to 1 ; on the other hand, in *S. alveolata* H., there are few A zoœcia, and *S. connexa* H. has only B zoœcia.

As Harmer* has shown, there is considerable difference in the teeth of A opercula of *magnilabris* from various localities, and we have opercula of this Wasin specimen without any, also the B opercula may be with or without lateral teeth. The A opercula of a 'Challenger' specimen (208·90·4.16.13) has the teeth so minute that they would be overlooked with a low power, but are seen with a quarter-inch objective.

The operculum of *Steganoporella* can scarcely be compared with the opercula of other Bryozoa, as it closes the whole of the distal chamber, and in a zoarium there is an amount of variation in size of the opercula which is unknown in other genera of Bryozoa. In a British Museum specimen of *S. truncata* Harm. from Port Dalrymple, there are a few cases where the operculum is thrown back, and then the whole of the opercular opening (that is over the distal chamber) is covered by a membrane with a large round opening, thus furnishing a most interesting form of closure.

The wall, dividing the two chambers, passes vertically from the opercular wall to the basal wall, and in the middle there is a round opening, sometimes with a slight tubular projection through which the polypide passes. The polypide rests partly in the two chambers, that is the tentacles are not entirely withdrawn into the proximal chamber. The embryos develop at the base of the distal chamber, but this chamber can by no means be spoken of as an ovicell.

The Wasin specimens show some blind zoœcia either entirely closed or with a central opening, and the same occurs in a specimen of *S. tubulosa* H., where two zoœcia are about the normal size, one with a large round opening, the other with an oval one, and in these the whole of the frontal wall is granular. On the other hand, a British Museum specimen of *S. sulcata* H. has two zoœcia entirely closed by the perforated cryptocyst.

The *S. magnilabris* from Wasin has floating in the proximal chamber many small oval bodies, surrounded by a membrane containing diatoms and other detritus. These are the excrement pellets, and they are evidently frequently ejected within the zoœcium.

Study of the growing ends is instructive. At first there is an absolutely empty oblong zoœcium covered with a plain membrane, and in this either A or B opercula may be formed, but at first the operculum has no basal sclerite (fig. 20), as this is formed subsequently. Next the proximal part of the cryptocyst

* *Loc. cit.* p. 234.

is formed (fig. 20, *z* 2–*z* 3), then the tube or opening between the two chambers (fig. 20, *z* 4) which is at a much lower level than the operculum, next the lip is formed, which at last reaches up to the operculum. The muscles are formed after the operculum, and the polypide not until after the tube and lip.

It has not been mentioned that the part between the main sclerite of the operculum is covered by a membrane, thus enclosing a space (fig. 17), and the tentacular sheath is fastened * between the two muscular attachments of the operculum, having a tissue across from one muscular attachment to the other (fig. 19, from *r*–*r*). As mentioned, the large distal muscle is attached to the operculum, but the large muscle just proximal to it in the A zoœcia is fastened by a tendon to the frontal membrane (fig. 19 *d*) close up to the operculum, where there is a slight thickening or sclerite. Harmer † speaks of this muscle as perhaps inserted into the frontal membrane immediately adjacent to the basal sclerite.

Further back (proximally) there is on each side a diagonal sclerite (fig. 14, *sc.*), to which the tendons of a smaller muscle are attached, which draws down the frontal membrane ‡. These are called depressor muscles by Harmer §‖.

In the B zoœcia the retractor muscles are much larger than in A, and are in two groups instead of one, but in the present species I am unable to find any very material difference between A and B zoœcia.

The embryos develop at the base of the distal chamber, but this chamber cannot be spoken of as an ovicell, for the polypides are, even when retracted, partly in this chamber. It seems that the embryo may exceptionally be in the proximal part of the zoœcium surrounded by a membrane, really an internal ovicell. This requires investigation.

The first polypide buds in the growing terminations are in the proximal end of the young zoœcia as usual, and are nearly always in one of the corners, consequently the polypide grows diagonally across the zoœcium, causing a slight amount of asymmetry in the zoœcium. The buds of the Bryozoa usually grow from near to a rosette-plate, the position of bud and polypide being thus affected by the position and number of these plates. In *S. magnilabris*, and probably generally in the genus, there are two large distal rosette-plates. In decalcified preparations a curious large fleshy

* We must keep in mind that in the Cheilostomata the tentacular sheath is fastened to the operculum and to the zoœcial wall.

† "Morph. of the Cheilostomata," Quart. Journ. Micr. Sc. n. s., vol. xlvi. p. 318 (1902).

‡ This was not readily made out at first, but some thick sections stained in Chlorazol blue enabled me to see it all clearly. This is a stain that will be found useful for staining muscles and some other tissue, but it is not a good nuclear stain. Material can be stained and decalcified at the same time, as acid does not affect the colour and it may be used for *intra vitam* staining. This stain was given to me by my friend Mr. Waddington, who has been unable to find out particulars as to its constitution.

§ *Loc. cit.* p. 320.

‖ It is interesting to find that the large "pores" in the cryptocyst of *Cupularia oweni* Busk are only for the passage of depressor muscles.

structure is found in connection with them (fig. 16). On the inner side (towards the older zoœcium) there is a large saucer-like portion with a fleshy club-like projection on the other. The wall of the zoœcium and the rosette-plate passes between the two.

From the tissue round one of these rosette-plates the polypides of the growing parts start, but many of the polypides have the retractor muscles always attached to the lateral wall. The tentacular part of the bud seems to be growing in one distal corner while the gut parts are growing in the other, and in the mature polypide a long tube connects the two (fig. 12). This narrow tube connecting the two parts is a character of the mature polypide, and is somewhat like that of the œsophageal tube of the Ctenostomata.

There are very few secondary buds to be seen (as the zoœcia nearly all contain perfect polypides); they, however, arise from tissue on the membrane crossing the operculum.

There are about 25 tentacles, four of which near the base are larger and broader than the others.

In other species of *Steganoporella* there is also considerable variation in the teeth of the opercula; for example, in a specimen of *S. buskii* H. from Algoa Bay, South Africa, in the British Museum, there is a B operculum without any teeth whatever, whereas the other opercula have small teeth.

Steganoporella is not yet known before late Tertiary, whereas *Thalamoporella* is much older.

Loc. Brazil; Jamaica; St. Vincent; Florida; China Seas; Singapore; Philippine Islands; Trincomalee; Amirante Isl., 20–25 fath. (*Thornely*). Wasin, Brit. East Africa, 10 fath. (500) (520); Chuaka, Zanzibar Channel, 2 fath. (508), collected by Crossland.

Fossil. Australian Tertiaries.

Cribrilina radiata Moll.

Loc. Cosmopolitan. Ras Osowamembe, Zanzibar Channel, 10 fath., on *Adeonella platalea*, collected by Crossland.

Hippothoa divaricata Lamouroux.

Loc. Wasin, Brit. East Africa, 10 fath. (520), on shell, collected by Crossland.

Hippothoa distans MacGillivray.

For synonyms see Waters, "Bryozoa," Résultats du Voyage du S.Y. Belgica, p. 54 & pl. iii. fig. 8 (1904).

Loc. Wasin, Brit. East Africa, 10 fath. (520), on shell, collected by Crossland.

Schizoporella unicornis Johnston.

Waters, "Bryozoa of the Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. p. 143, pl. xii. figs. 12, 13 (1909).

Some pieces are either one or two layered, and here again I

have been able to see the zoœcia superimposed, so that both lateral and distal walls of the upper layer are above the similar walls of the lower layer *. Reuss has shown the same thing in *Cumulipora angulata* v. M., and I have in previous papers referred to it in Meliceritidæ.

In some other species of *Schizoporella* the superimposed layers grow quite differently (see p. 504).

Loc. Add: "From bottom of s.s. 'Juba,' which always remains in Zanzibar waters" (511), collected by Crossland.

Schizoporella pertusa Esper.

See Miss Jelly's Catalogue, and add:—

Lepralia pertusa Calvet, "Bry. Mar. de Cette," Trav. Inst. de Zool. de l'Université de Montpellier, ser. 2, vol. i. p. 51; "Bry. Mar. de Corse," op. cit. vol. ii. p. 26; Jullien & Calvet, "Bry. prov. des Camp. de l'Hirondelle," pp. 69, 134.

Schizoporella pertusa Calvet, "Exp. Sc. du Travailleur et du Talisman," p. 416.

Loc. British; Labrador; Atlantic; Florida; Mediterranean; Mazatlan; Australia; Samoa; China Seas. Wasin, Brit. East Africa, 10 fath. (500) (520), collected by Crossland.

Schizoporella nivea Busk. (Pl. LXX. figs. 1–3, 7–9, & Pl. LXXIII. fig. 16; and text-fig. 80.)

Schizoporella nivea Busk, Zool. Chall. Exp. vol. x. pt. xxx. p. 163, pl. xvii. fig. 1 (1884); Philipps, in Willey's Zool. Results, pt. iv. p. 440 (1889); Thornely, Ceylon Pearl-Oyster Fisheries, vol. iv. p. 114 (1905); Rec. Indian Mus. vol. i. pt. 3, no. 13, p. 189 (1907); Waters, Rep. Mar. Biol. of the Sudanese Red Sea, "Bryozoa," Journ. Linn. Soc., Zool. vol. xxxi. p. 168, pl. xvii. figs. 2–4 (1909); Thornely, "Mar. Poly. of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 148 (1912).

Zoarium in Hemescharan form. Zoœcia quadrate, distinctly separated, fairly large pores over the surface, an avicularium near each upper corner with broad triangular to nearly semicircular mandibles, sometimes a small avicularium at one of the lower corners, Below the aperture there is frequently, in the older zoœcia from (501), a mucro which may be long spreading out at the ends, or there may be a thin lamina radiating in four directions the whole length of the mucro. These mucros are more frequent on the ovicelligerous zoœcia. The oral aperture is nearly circular, has a wide poster, and there are fine lines across the operculum (fig. 2).

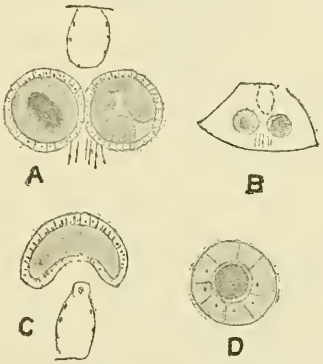
The ovicell is large, raised, globular, with a ridge from the middle of the proximal edge, shortly bifurcating to each side, at any rate in the older zoœcia. The pores over the surface of the

* Reuss, "Zur Fauna des deutschen Oberoligocäns," pt. ii., Sitzb. d. k. Akad. der Wissensch., Wien, math.-nat. Cl., vol. l. Abth. 1, p. 644 (31), pl. ix. fig. 1 (1864); "Die Foram., Anth. und Bryozoen des deutschen Septarienthones," Denk. s. d. k. Akad. der Wissensch., Wien, math.-nat. Cl., vol. xxv. p. 179 (63), pl. viii. fig. 12 (1865).

ovicell are fairly large, though slightly smaller than those of the zoœcia.

The small avicularium at the distal corner (figs. 7–9) has short and wide glands which at the lower part are joined together, and no other avicularian glands yet seen quite resemble these (text-fig. 80). Avicularian glands occur in *Lepralia foliacea* Ell. & Sol., *L. clivosa* Waters, *L. margaritifera*, *Smittia trispinosa* Johnst., *Porella plana* Hincks, *P. acutirostris* Smitt, *Retepora cellulosa* L., and other *Reteporæ*. In all these cases there are also oral glands. The oral glands of *S. nivea* are but small with the end cells the larger and darker (Pl. LXXIII. fig. 16, *gl.*).

Text-fig. 80.



Avicularian glands of the small avicularia of *Schizoporella nivea*.

A, the two glands separated, × 320. B, the same, × 100.
C, glands united, × 320. D, gland, × 320.

There are 16 tentacles, no pore-chambers, but on the lateral walls there are about eight rosette-plates near the basal wall, also on the distal wall there are about six situated near the base.

The internal membrane of the zoœcium projects in a sac-like manner into the ovicell (fig. 16). This sac is about the width of the zoœcium, and is provided with a large number of muscles (fig. 16, *sc.*) radiating from near the operculum. From a whole preparation it seems that the ovum passes into this sac, which is then ruptured (fig. 16, *r*) to allow of the passage of the large ovum into the ovicell. I think there is no doubt of my interpretation, although a ruptured membrane has only been seen in one case. The ovarium consists of a number of large ovarian cells.

Some of the older zoœcia are closed by a calcareous layer over the operculum, with a calcareous bar or lamina, extending from side to side (Pl. LXX. fig. 3) curving round to the sinus, a position which is fairly constant, not accidental. In older zoœcia there is sometimes a calcareous bar straight across the aperture, and there

may be no operculum remaining underneath it. Frequently a tubular projection occurs in the middle of the supra-opercular calcareous layer, and there is a closure of the same kind in *Schizoporella unicornis* and other Schizoporellidæ and various other genera besides some Tertiary fossils; and a similar structure has been described in "*Lepralia*"* *syringopora* Rss. and is found in various Adeonidæ †. It can be seen in *S. nivea* that these raised ledges across the operculum are the basal lines for a superimposed layer even though the layer is seldom completed; and a South African species which, though a larger and distinct form, is very similar to *S. nivea*, explains the growth across the operculum more fully. In it we have the commencement of a superimposed new layer of zoœcia, and in one specimen there are about fifty zoœcia together on which the walls for another layer are all mapped out, and the wall passes over the operculum, nearly always with the same curved line as in *S. nivea*.

I described and figured a similar growth in *Meliceritites* ‡ and apparently it occurs in various other cases. On the other hand, I have specimens of *Schizoporella unicornis* Johnst. from Cape Verde Islands and Zanzibar, in which there are many layers, and each following layer is formed by the new walls, nearly always growing exactly above the walls of the older layer. Nevertheless, there is, in some cases, a curved calcareous ridge over the operculum for which there seems no object. In *S. unicornis* there is often a tubule on the calcareous closure.

Some stained sections of *Adeonella contorta* Mich. in which there are superimposed layers, show this tubule as an inverted funnel with a long tube (over the operculum) attached to the tissues below the operculum. These closures can only be compared, in a limited sense, with the tubules of the closures of the Cyclostomata, as the operculum is unaltered and there is no perforation. There are also membranous closures, and the subject deserves further study. The Schizoporellidæ and the Adeonidæ are apparently the two families most likely to throw light on the closures of the Cheilostomata. Of course we do not find the closures in the younger zoœcia, only in the older ones. In both these families blind cells are very frequent §.

The Zanzibar forms are not separated as varieties or species, although the one with the tall mucro might perhaps be called var. *wasinensis* (Pl. LXX. fig. 1) on this account. It may be the *Schizoporella linearis* of Hincks, Ann. Mag. Nat. Hist. ser. 5, vol. vii. p. 159, pl. ix, fig. 2, to which there is no description or locality.

* Waters, "North Italian Bryozoa," Q. Journ. Geol. Soc. vol. xlvii. p. 20, pl. iii. figs. 3, 4 (1891).

† Waters, "A Structure in *Adeonella contorta* Mich.," Ann. Mag. Nat. Hist. ser. 8, vol. ix. p. 498 (1912).

‡ "On Cheilostomatous characters in fossil Bryozoa," Ann. Mag. Nat. Hist. ser. 6, vol. viii. p. 52, pl. vi. fig. 4 (1891).

§ Since the above was written Levinsen has published an important work, "Studies on the Cyclostomata Operculata," D. Kgl. Danske Vidensk. Selsk. Skr. 7 R., Nat. og Math. Afd. vol. x. pt. 1, 1912, dealing with Meliceritidæ.

What he calls the opercula of these fossils I should speak of as the closures, for

Frequently a hydroid is growing over the surface. This seems to be a species of *Clava* and may be the same species as one growing in *Holoporella columnaris* B., and *H. pigmentaria* Waters, in which it may pass through several layers of zoœcia. Sections showed that the stolons were spread under the *H. columnaris*, indicating that the growth of the *Holoporella* occurred over established colonies of *Clava* round which the *Holoporella* formed calcareous tubular walls *.

(1) *S. nivea* belongs to a group in which all the species have a wide sinus or arc, the surface is perforated as is also the ovicell, there are quite small oral glands or but very moderate sized ones. The opercula have the muscular attachment close to the border and fairly near to the distal end. This group I referred to † as including the types of *Schizoporella*, and belonging to it are *S. sanguinea* Norm., *S. linearis* Hass., *S. harmsworthii* Waters, *S. auriculata* Hass., *S. galeata* B.? etc., and a new species from S. Africa. Levinsen includes several other species under *Schizoporella*, but I am by no means sure that all his species will remain in the same genus, for in (2) *S. unicornis* Johnst. and var. *errata* Waters, *S. longirostris* Hincks, *S. spongites*, *S. biaperta* Mich., the sinus is much narrower, and what is of most importance, the muscular attachments are some distance from the border of the operculum. In *S. biaperta* the ovicell has a flat area with perforations round the border.

(3) In the group *S. vulgaris* Moll., *S. viridis* Thorn., there is a similar operculum, and it is in part the *Escharina* of Levinsen.

In the same place I showed that there was a group which might be placed in a modified *Buffonella* Jullien, in which the surface of both the zoarium and the ovicell is imperforate, also there is a small suboral avicularium, and the opercula have the muscular attachments some distance from the border as in the last group. It is represented by *S. ridleyi* MacG., *S. simplex*

I consider that the chitinous operculum was under the closure, and I should like to see the name operculum confined to the movable chitinous appendage. Levinsen on Plate i. figs. 15, 16, shows *Meliceritites vielbanci* d'Orb. with tubules to the closures, such as I have seen in recent Cheilostomata, and a number of similar closures are figured. Without there being perhaps any wide divergence of view I should not describe these as being regenerated zoœcia, for while Levinsen has described regenerated zoœcia, I have not seen anything to suggest their being common, and further, although we know that the polypides are regenerated in the closured zoœcia, this by no means always takes place, as, for example, in the older parts of stems and when there is more than one layer. It therefore seems unadvisable to speak of them as regenerated zoœcia when they are frequently permanently closed.

I have suggested to Professor Levinsen that the sunk walls with few openings as in *Meliceritites magnifica* (*op. cit.* Pl. i fig. 7), may be comparable with the perforated wall or closure UNDER THE OPERCULUM in *Vittaticella* (see page 484). These are also to be compared with the partial closure I described in *M. royana* Waters, Ann. Mag. Nat. Hist. ser. 6, vol. viii. pl. vi. figs. 2, 6 (1891). Levinsen in his most valuable work has given full figures and descriptions of the structure of Meliceritidæ, and as I believe that many analogous structures are found in the Cheilostomata, a thorough examination of the closures of living forms is much to be desired.

* Waters, Report on Sudanese Bryozoa, p. 254.

† Waters, Résultats du Voyage du S.Y. Belgica, "Bryozoa," p. 42 (1904).

d'Orb., *S. rimosa* Jull., *S. marsupifera* Busk, *S. tumida* H., *S. levata* H., *S. levigata* Waters.

It is quite clear that there are several groups that can be separated off from the old *Schizoporella*, but until more living and spirit specimens have been examined important characters remain unconsidered.

Loc. Since I gave the localities of *S. nivea* Miss Thornely has reported it from Amirante, 29 fath.; Seychelles, 39 fath.; Providence, 50–78 fath. It was procured from Wasin, Brit. East Africa, 10 fath. (501); Ras Osowamembe, Zanzibar Channel, 10 fath. (504); Prison Island, Zanzibar Channel, 10 fath. (505), and with the large mucro from Wasin, 10 fath., which may have to be called var. *wasinensis*: collected by Crossland.

Schizoporella montferrandi Audouin.

Lepralia montferrandi Waters, Rep. Mar. Biol. of the Sudanese Red Sea, "Bryozoa," Journ. Linn. Soc., Zool. vol. xxxi. p. 171, pl. xvii. figs. 15–18 (1909). To which add :—

Schizoporella pachnoides MacG. Trans. Roy. Soc. Vict. vol. xxiii. p. 180 (1886); Prod. Zool. Victoria, dec. xix. p. 314, pl. 186, fig. 6 (1889).

This must go to *Schizoporella* as now limited (see p. 505). It is closely related to *S. galeata*, but as I have said they must probably be separated.

Add :—*Loc.* Victoria (*MacG.*). Wasin, Brit. East Africa, 10 fath. (520), collected by Crossland.

Gemellipora protusa Thornely. (Pl. LXX. figs. 4–6.)

Gemellipora protusa Thornely, Ceylon Pearl-Oyster Fisheries, vol. iv. Polyzoa, p. 119, pl. iv. fig. 7 (1905).

Zoarium incrusting. Zoœcia rhomboidal, raised, with pores round the border; surface with few pores and granular. Oral aperture clithridiate, very long, with large lateral contractions, and the peristome frequently much raised, especially at the side. At one side of the zoœcium directed downwards a short wide triangular avicularium with a stout bar, and sometimes a second roundish avicularium near to the side of the aperture. Ovicell small, raised, globose, with very thick walls, perforated, much open in front and not closed by the operculum.

Loc. Gulf of Manaar (*Th.*). Wasin, Brit. East Africa, 10 fath., received dry (520), collected by Crossland.

Trypostega venusta Norman.

Lepralia venusta Norman, Ann. Mag. Nat. Hist. ser. 3, vol. xiii. p. 84, pl. x. figs. 2, 3 (1864).

Schizoporella venusta Hincks, Brit. Mar. Poly. p. 276, pl. xxx. figs. 6, 7 (1880): Kirkpatrick, Ann. Mag. Nat. Hist. ser. 6, vol. i. p. 76 (1888); "Hyd. & Polyzoa from the China Sea," Ann. Mag.

Nat. Hist. ser. 6, vol. v. p. 17 (1890); Proc. Roy. Dublin Soc. n. s. vol. vi. p. 612 (1890): Calvet, Expéd. Scient. du Travailleur et du Talisman, vol. viii. p. 416 (1907).

Trypostega venusta Levinsen, "Studies on Bryozoa," Vid. Medd. f. d. Naturh. Foren. i Kjøbenhavn, p. 23 (1902); Morph. & Syst. Studies on Chil. Bry. p. 281, pl. xix. figs. 1 *a*–1*d*, pl. xxii. figs. 13 *a*–13 *d* (1909); Norman, "Polyzoa from Madeira," Journ. Linn. Soc., Zool. vol. xxx. p. 299 (1909).

Gemellipora glabra, form *striatula* Smitt, 'Floridan Bryozoa,' pt. ii. p. 37, pl. xi. p. 207 (1873); Thornely, "Mar. Poly. Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 149 (1912).

Gemellipora striatula MacG. Prod. Zool. Vict. dec. xiv. p. 150, pl. 138. fig. 10 (1887).

Lepralia striatula MacG. Tr. Roy. Soc. Vict. p. 134, pl. iii. fig. 17 (1882).

Schizoporella striatula Waters, Q. Journ. Geol. Soc. vol. xli. p. 301 (1885); Philipps, "Poly. Loyalty Isles, &c.," Willey's Zool. Results, pt. iv. p. 440 (1899).

Mollia tuberculata d'Orb. Paléont. Franç. p. 388; see Waters, Ann. Mag. Nat. Hist. ser. 7, vol. xv. p. 6.

Lepralia inornata Gabb & Horn belongs to this group.

I should have hesitated, at present, to put this in a new genus merely on account of the small chamber above the zoœcium, which no doubt must be considered as a vestigial avicularium, but as a genus may be required it will now cause less confusion to use Levinsen's name. *Lepralia turgescens* Reuss, "Foss. Bry. Oest.-Ung. Miocäns," Denk. K. Akad. der Wissensch. Wien, math.-naturwiss. Class., vol. xxxiii. p. 36, pl. viii. fig. 7, has an avicularium, which, judging from the figure, corresponds to the small chamber above the zoœcium in *T. venusta*, and also the avicularium of *Chorizopora brongniarti* Aud. is often similarly situated.

Sections of the specimen from Wasin show that there are no bands of muscles in the chamber above the zoœcium, but there are protoplasmic bands to the frontal disk, starting from two rosette-plates at the proximal end of the small chamber, and near the distal end there is a small group of cells at each side, which must probably be considered as glands. There are a few irregular large chambers almost as large as the ordinary zoœcia closed in the same way as these small supra-zoœcial chambers.

There are but few ovarian cells in the ovarium, usually two, sometimes three or four, and one may be seen developed to a considerable size. The embryos develop fully in the ovicell. No suboral glands have been found.

Loc. British; Guernsey; Calvados; Florida; Madeira (*Norman*); Azores; Cape Verde Islands (*C.*); Lifu, Loyalty Isl. (*Ph.*); China Seas (Tizard Bank), 27 fath.; Torres Straits (*K.*); Amirante, 22–85 fath., Saya de Malha, 29–125 fath. (*Thornely*); Mauritius. Wasin, Brit. East Africa, 10 fath. (500), collected by Crossland.

Fossil. River Murray Cliffs, South Australia.

Arthropoma cecilii Audouin.

Flustra cecilii Aud. 'Zool. Egypte,' p. 66 (239), pl. viii. fig. 3; see Miss Jelly's catalogue.

Arthropoma cecilii Levinsen, Morph & Syst. Studies on the Cheil. Bry. p. 332 (1909).

Schizoporella cecilii Thornely, "Mar. Poly of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 147 (1910).

In my Report of the Antarctic Bryozoa from the Voyage du S.Y. Belgica, p. 50, I called attention to this group and now Levinsen has given it a name. As I previously said *Phonicosia* Jullien may belong here, but Jullien's specimens are not sufficiently complete to settle the question.

Loc. Distribution general in the north temperate zone, the tropics, and Australia. Prison Island, Zanzibar Channel, on the shore (513), collected by Crossland.

Fossil. European and Australian Tertiaries.

Osthimosia zanzibariensis, sp. n. (Pl. LXXIII. figs. 9, 15.)

Zoarium incrusting seaweed, small, irregular. Zoœcia subglobose, smooth. Oral aperture with distinct sinus, otherwise nearly circular, a small semicircular avicularium at each side of the aperture, and when there is an ovicell usually a second pair of avicularia. Surface of the zoœcia imperforate with longitudinal ribs in the older zoœcia, vicarious avicularia among the zoœcia having expanded spatulate mandibles. Ovicell large, wide, globose, perforated all over.

In having the perforated ovicells this is like *Cellepora avicularis* Hincks, to which it is closely allied, but the median avicularium is absent. A perforated ovicell occurs in *C. avicularis* H., *C. coronopus* B., *C. megasoma* MacG., *C. conica* Busk, *C. redoutii* * Aud. In the early stages this form resembles *Schizoporella biaperta* Mich., but vicarious spatulate avicularia are unknown in *S. biaperta*. The operculum is thinner than that of *C. conica*, and the walls also are thinner. I find that *C. conica* is the young form of a species determined by Busk as *C. simonensis* † B., an erect cylindrical species. The oral aperture of both *C. conica* and *C. avicularis* is slightly larger than that of this species from Prison Island.

After removing from *Cellepora* the genera *Holoporella* and *Lagenipora* there is the present group with a triangular sinus, the ovicell perforated and the surface of the zoœcium imperforate except near the border, and the group includes *C. avicularis* H., *C. conica* Busk, *C. coronopus* S. Woods, leaving still another group with imperforate ovicells, but a small semilunar area or mark near the proximal part, and a marked sinus in the oral aperture, as, for example, *C. evexa* Jull., *C. eatonensis* B.

* This is only a variety of *C. avicularis* H. I have a specimen from a sounding-line in the Red Sea.

† Waters, Zool. Chall. Exp. vol. xxxi. pt. lxxix. p. 35 (1889).

Hincks in his 'Brit. Mar. Polyzoa' says that the type of *Cellepora* was *pumicosa*, but this is not the case, for as Levinsen points out in his large work, Linnæus refers to *C. ramulosa* as the first species of *Cellepora*. Hincks incorrectly considered it the genus of Fabricius. Levinsen is, however, mistaken in supposing that *C. ramulosa* is schizostomous, as it belongs to the holostomatous group, though not to *Holoporella* *. I have not as yet had any opportunity of cutting sections of *C. ramulosa*, but the operculum has the proximal border but slightly curved, and the small muscular attachments are close to the thicker part of the border. In most *Holoporellæ* the attachment is a little nearer to the edge, on the other hand it is much closer to the distal edge than is usual in the Schizostomous groups.

The ovicell of *ramulosa* is cap-like as in *Holoporella* etc., and although Hincks says perforate or imperforate, none of the specimens in my collection, nor any in the British Museum general collections, including Busk's and Hincks's,' have a perforate ovicell; also in the Norman collection a few from each locality were examined without finding any perforate. There are two or three species externally corresponding with *C. ramulosa*, so that a mistake is easily made, and in three cases friends have sent me specimens so marked, of which only a part were *ramulosa*.

By taking (even if provisionally) *C. ramulosa* as definitely described by Hincks, and perhaps by some before him, as the type of *Cellepora*, we get out of a difficulty, for when *Schismopora* was created by MacGillivray *Cellepora* remained for the holostomous division. *C. ramulosa* is the first of Linnæus' species, the others being *spongites*, *pumicosa*, *ciliata*, *hyalina*. Linnæus' description of *ramulosa* would do for several species of branching forms, and we are doubtful what the other species were meant for. In Linnæus' copy of the 12th edition of Syst. Naturæ, there is in his small writing, under *C. ramulosa*, a reference "nidros pl. i. fig. 6," which was hieroglyphic to me until Dr. Daydon Jackson kindly explained that it referred to Det Kongelige Norske Videnskabets Selskabs Skriften, 4th part, 1768–1774, in which there is a paper by Gunnerus, who supplied Linnæus with both *C. ramulosa* and *C. pumicosa*. In this work (pl. i. fig. 6) is a figure of a *Cellepora*, which, judging from the locality, "Oceano Norvegico," is probably † *C. incrassata* Sm., although *C. coronopus* S. Woods, an entirely different species from the Mediterranean, corresponds equally well with this figure, which shows nothing but zoarial shape. It is, however, what Linnæus described as *C. ramulosa*. On the same plate the figure 7 shows a similar growth, though with smaller branches, and to this under *C. pumicosa* Linnæus refers by a

* There are various species of holostomous Bryozoa which do not belong to *Holoporella* Waters, as, for instance, *C. sardonica* Waters, which will fall into Holoporellidæ.

† Waters, "Bry. from Franz-Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. p. 94 (1900).

similar note. A long time ago I showed * that the *C. pumicosa* as we have understood it had nothing whatever to do with *C. pumicosa* L., as it does not in any way correspond with Linnæus' description, besides which he refers to a figure by Marsigli which probably is a figure of *C. coronopus*. I then referred to it as *C. pumicosa* Busk (*non* L.) and have continued to do so. Fig. 7 may be a figure of *C. ramulosa* Hincks, etc. though called *pumicosa* by Linnæus; there are, however, several other species that it might represent. After this record of mistakes about two well known species, showing how little we can know what the earlier writers meant, we should be allowed to return to our senses, and use these long established specific names for thoroughly described and well recognised species, namely *C. pumicosa* Busk, *C. ramulosa* Hincks, but if we retain *Cellepora* for *ramulosa* the *C. pumicosa* Busk becomes *Osthimosia* Jullien. This group was divided off in the same year by Jullien as *Osthimosia*, and as *Schismopora* by MacGillivray, but it seems that Jullien's name was published a few months the earlier. The opercula of this group are all of the same type, with the opercular attachment some distance from the border of the operculum. The group is left by Levinsen under *Cellepora*, through misunderstanding *C. ramulosa*. The ovicell of *Osthimosia* is, at any rate, nearly always punctured.

This leaves the *Cellepora* of Hincks divided into Holoporellidæ (holostomatous), and the schizostomatous forms into *Osthimosia* and *Lagenipora*.

Loc. Prison Island, Zanzibar Channel, 8 fath. (505); Ras Osowamembe, Zanzibar Channel, 10 fath. (504), collected by Crossland.

Lagenipora rota MacGillivray.

Cellepora rota MacG. Trans. Roy. Soc. Vict. vol. xxi. p. 116 (11) pl. iii. fig. 6 (1885); Prod. Zool. Vict. dec. xv. p. 184, pl. 148. fig. 3 (1887).

Levinsen would call this *Siniopelta*, but it is what I have previously put under *Lagenipora*, as the position and character of the ovicells of *L. socialis* Hincks seem to me to be the same as in the group which Levinsen calls *Siniopelta*. As Levinsen has not agreed with me, I have also, besides again examining the British Museum specimens, through the kindness of Professor Hickson, examined the specimens from Miss Jelly's collection in the Victoria University Museum. Miss Jelly first found *L. socialis* in Hastings, and presumably all known Hastings specimens were collected by her. The Hastings specimens in the Victoria Museum did not show the ovicell, but one so named by Miss Jelly, from Guernsey, has some ovicells and also shows the spinous processes well.

The ovicell of the Guernsey specimen is situated on the wall

* Waters, "Bryozoa of the Bay of Naples," Ann. Mag. Nat. Hist. ser. 5, vol. iii. p. 198 (1879).

of the peristome, which frequently extends beyond it as a complete tube, and the ovicell has an area which is flat or slightly rounded and is surrounded by a ridge, while at each corner inside the ridge there is a pit. It seems justifiable to call the part surrounded by the ridge an area, but if there is any objection to this it might be called a tabula. In this case the "calcareous base" is very slightly developed and might be overlooked, and except that the Guernsey specimen is slightly granular or rather nodulated there is but little difference between it and *Lagenipora lucida* Hincks from Madeira, except that *L. lucida* has pores round the area as figured by me *, but I have not the opportunity of now comparing any *L. lucida* having ovicells.

Now in *Lagenipora nitens* MacG. from Port Phillip Heads, which I considered only a variety of *lucida*, the ovicell is just the same shape and in the same position, while close to the ridge of the area there is a row of pores; also *L. boryii* Aud. from the Mediterranean has a row of pores in the same place, whereas in *L. rota* MacG. and some other species there are radiating grooves. An Australian species of *Lagenipora* has the area evenly perforated all over. The pores or pits of *L. socialis*, though difficult to trace, are no doubt small and close to the edge. When I first thought I saw pores it was puzzling not to find a complete row, and there was a doubt whether they might only result from accidental damage, but no doubt the explanation is that there is only one at each corner. There must be something wrong if *Lagenipora socialis* and *L. lucida* are placed in different genera.

Loc. Victoria (*MacG.*). Wasin, Brit. East Africa, 10 fath. (507), collected by Crossland.

Haswellia australiensis Haswell.

Myriozoum australiense Haswell, Proc. Linn. Soc. N.S. Wales, vol. v. pt. 1, p. 43, pl. iii. figs. 9–11 (1880).

Haswellia australiensis Busk, "Polyzoa," Zool. Chall. Exp. vol. x. pt. xxx. p. 172, pl. xxiv. fig. 9 (1884); Kirkpatrick, Proc. Roy. Dublin Soc. vol. vi. p. 612 (1890); Meissner, M., aus Semon "Zool. Forsch. Reisen in Australien und Malay," Jena. Denkschr. vol. viii. p. 731 (1902); Levinsen, Morph. & Syst. Studies of the Cheil. Bryozoa, p. 297, pl. xvi. figs. 2 *a*–2 *b* (1909).

Porina coronata var. *labrosa* Waters, Zool. Chall. Exp. vol. xxxi. pt. lxxix. p. 32 (1889).

Levinsen places this in Myriozoidæ †, but it seems somewhat doubtful whether the genera grouped together by Levinsen will remain in the same family (see p. 520).

The series of zoœcia in *H. australiensis* are all on the same horizon, and usually at the beginning of each branch there are six zoœcia in a whorl, there is then another whorl with six, then one with eight when a bifurcation takes place, and then again

* Journ. R. Micr. Soc. 1899, p. 13, pl. iii. figs. 25, 27, 30 (1899).

† *Loc. cit.*, see page 296.

each of the new series commences with six. *H. australiensis* has 19–21 tentacles. Unfortunately none of the specimens now examined have ovicells. The *Haswellia* group is well represented in the North Italian Tertiaries, and although some appear to be almost identical with living species, it seems better to keep them distinct, as all the structures cannot be compared.

There is over the surface an outer membrane, and then under this there are membranes of the two walls of the shell showing when decalcified the position of the pore-tubes. Some specimens from Wasin have a pink colour.

The operculum of the species and of the *H. coronata* H. or *H. gracilis*, whichever we may have to call it, is identical, having the opercular attachment very high up and elongate (see my figure in Ann. Mag. Nat. Hist. ser. 5, vol. xx. pl. vi.). The operculum of *H. auriculata* B. has the muscular attachments much lower down and not so near the edge; further, the ovicell which is but slightly raised, has a semicircular area, and the surface of the zoœcium has not pores all over. It seems exceedingly doubtful whether *H. auriculata* should remain in *Haswellia*, but I have never had sufficient material in my hands for a complete examination. *H. grandipora* Waters is *Haswellia*, and I now think must stand as a species.

Loc. Holborn Island, Queensland (*Hasw.*); near Torres Straits (*Chall.*); Thursday Island, Torres Straits (*Meissner*); Formosa Channel (*Levinsen*). Wasin, Brit. East Africa, 10 fath. (500, 501, 507, 520), collected by Crossland.

Tubucellaria cereoides, var. chuakensis Waters.

Tubucellaria cereoides var. *chuakensis* Waters, ' Tubucellaria," Journ. Linn. Soc., Zool. vol. xxx. p. 130, pl. xv. figs. 10–13, 18, 19, pl. xvi. figs. 20–25 (1907); Thornely, "Mar. Poly. Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 146 (1910).

Tubucellaria fusiformis Busk (*non* d'Orb.), Zool. Chall. Exp. vol. x. p. 100 (1884).

Loc. Torres Straits (*Busk*); Grahamstown, S. Africa; Providence, 50–78 faths. Chuaka, Zanzibar, 3 fath. (512, 524); Wasin, Brit. E. Africa, 10 fath. (501); Chaki-Chaki, Pemba Island (517), low water, collected by Crossland.

Tubucellaria fusiformis d'Orbigny.

Waters, *loc. cit.* p. 131, pl. xv. figs. 1, 2, 3, 14.

Loc. Malacca, Amirante Is., Chuaka, Zanzibar, 3 fath. (528); Wasin, Brit. East Africa, 10 fath. (520), collected by Crossland.

Tubucellaria zanzibariensis Waters.

Waters, *loc. cit.* p. 131, pl. xv. figs. 4–7; Thornely, "Mar. Poly. Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 146 (1912).

Loc. Saya de Malha, 145–150 faths.; Farquahar Reef;

Cargados, 28 fath. Wasin, Brit. East Africa, 10 fath. (501); Ras Osowamembe, Zanzibar Channel, 10 fath. (504, 514); Prison Island, Zanzibar Channel (505); Chuaka Bay: collected by Crossland.

Smittina trispinosa, var. protecta Thornely.

Smittia trispinosa, var. *protecta* Thornely, Ceylon Pearl-Oyster Fisheries, vol. iv. Polyzoa, p. 123 (1905); Waters, "Mar. Biol. of the Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. p. 173, pl. xvii. figs. 5, 6 (1908).

Smittia nitida Hincks, Ann. Mag. Nat. Hist. ser. 5, vol. vii. p. 159, pl. ix. fig. 5 (1881).

There are two specimens with the large avicularia situated diagonally distal to the oral aperture. The ovicells of this variety and of typical *nitida* are similar, and there are some specimens with a large, almost spinous, process at the proximal part of the peristome, with a similar process on the ovicell just distal to the area of pores. An identically similar form occurs off the Cape Verde Islands, and Osburn * mentions an umbo in some forms of *nitida* "behind the orifice," and he shows how *S. trispinosa* var. *nitida* is subject to great variation with regard to the avicularia and the peristome.

Loc. Gulf of Manaar (*Th.*); "Africa" (*J.*); Red Sea (*W.*). Wasin, Brit. E. Africa, 10 fath. (520), collected by Crossland.

Smittina trispinosa, var. spathulata MacGillivray.

Waters, "Mar. Biol. Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. p. 156.

The ovicell has a distinct area, the border of which sometimes rises as an umbo, or is divided into two sharp, erect processes. *S. trispinosa* var. *bimucronata* Hincks belongs to this group, but it is doubtful whether it should be separated as a variety, as there is normally such considerable variation in the zoœcia. From (504) there are very large vicarious avicularia, directed either distally or proximally.

Smittina is used instead of *Smittia*, though not including all that Levinsen refers to it, for I consider it a group in which the operculum is usually very thin, almost membranous, with the lower edge straight. In the species so far examined, the oral glands are quite small and usually more or less attached to the tentacular sheath. In the aperture a lyrula is usually found with the operculum under the cardellæ but over the lyrula. *Pseudoflustra solida* Stimp., and *Lepralia pallasiana*, together with its allies, show many differences and do not seem to belong here.

Loc. Bass's Straits; Torres Straits; Red Sea. Wasin, Brit. E. Africa, 10 fath. (520); Ras Osowamembe, Zanzibar Channel, 10 fath. (504), collected by Crossland.

* "The Bryozoa of the Woods Hole Region," Bull. Bur. of Fisheries, vol. xxx. p. 246 (1912).

Smittina tropica Waters.

Smittia tropica Waters, "Mar. Biol. of the Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. p. 174, pl. xvii. figs. 10–14 (1909).

Loc. Red Sea. Wasin, 20 fath. (520), collected by Crossland.

Smittina sp.

There is a small piece of *Smittina* encrusting *Adeonella platalea*, which has the peristome very much raised, especially at the distal part, and there is apparently a triangular avicularium in the lip. There are perforations round the border of the zoœcium, and the small ovicell is not much raised and is at the base of the peristome, and at each side of the ovicell close to the edge there is a small clear spot. There are two openings in the ovicell of *S. oculata* MacG., and sometimes others; and I find in a specimen sent me by Jullien as *S. longirostris* J., there is a similar spot at the side of an ovicell. Jullien's species has large frontal avicularia, whereas none are found on the small fragment. The lyrula is at first very narrow but spreads out widely on each side. I hesitate to give it a name until better specimens are found.

Loc. Ras Osowamembe, Zanzibar Channel, 10 fath. (504).

Lepralia feegensis Busk. (Pl. LXX. figs. 21, 22.)

Lepralia feegensis Busk, Zool. Chall. Exp. vol. x. pt. xxx. p. 144, pl. xxii. fig. 9 (1884); Philipps, in Willey's Zool. Results, pt. iv. p. 446, pl. xliii. fig. 7 (1889); MacGillivray, Proc. Roy. Soc. Vict. n. s. vol. iii. p. 81, pl. x. figs. 1, 2 (1891); Thornely, Ceylon Pearl-Oyster Fisheries, vol. iv. p. 121 (1905); Rec. of Indian Mus. vol. i. pt. 3, no. 13, p. 190 (1907); "Mar. Polyzoa Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 150 (1912).

Hippopodina feegensis, Levinsen, Morph. & Syst. Studies on the Cheil. Bry. p. 353, pl. xxiv. figs. 3*a*–3*f* (1909).

Miss Philipps described and figured the ovicell as with opaque granulations, globular and depressed; and Miss Thornely, not aware that the ovicell had been seen, described it as with large circular pitted areas punctured in their centres. In a specimen in my collection, from "Singapore or Philippines," the ovicell has the pores fairly similar to, and about the same size as, the pores of the zoœcia. MacGillivray had previously described the ovicell of his *L. feegensis*, but as the avicularium, which is directed downwards, is in quite a different position, I doubt whether it is the *feegensis* of Busk. He described the ovicell as large, rounded, prominent, and marked similarly to the zoœcia. In the specimens from Zanzibar (501) there are no ovicells, glands, ovaria, or testes, but in those from (511) there are many ovicells which are perforated, though when the ovicell contains an ovum or embryo these perforations look dark and opaque.

There are about 26 tentacles, and the operculum closes the ovicell. There are several ovarian cells in an ovarium.

In the submandibular part of the avicularium there is a hammer-shaped thick chitinous piece for attachments of muscle. The proximal muscles are in several bundles and are attached to the base of the tentacles.

Lepralia is a genus which we have long wanted to see brought into order, but certainly further work is required. Hincks made a group *Lepralia*, and, no doubt, on the whole the species of his group are closely related, but he unquestionably placed some there which should have gone in his *Schizoporella* and other genera. Neviani, taking species with a horse-shoe aperture, made a genus *Hippoporina*, but he still retained some which must be separated, and very little was gained by his new name. In *Lepralia* the operculum is usually thick and has a strengthening band at each side with the muscles attached near the distal end of the band. The sides of the operculum are either straight or much contracted where the lateral teeth of the aperture occur. This will remain a fairly large group even when extraneous species have been removed, but we hardly know where Levinsen would place them, as hardly any of them are mentioned. *L. adpressa*, *L. hippopus*, *L. rectilineata* Hincks, find no place. *Lepralia feegensis* is made the sole representative of a new genus *Hippopodina*, but the characters given seem insufficient for separation, as there are a considerable number with the same general characters.

Some *Lepralia* Levinsen places under *Smittina*, a new name for *Smittia*, but the true *Smittia* to which he alludes have a very thin membranous operculum with straight proximal edge hardly separated from the frontal membrane, and there is usually a lyrula, which is perhaps a structural correlation with the thin membranous operculum; further, there are very small oral glands often partly attached to the tentacular sheath. I find it quite impossible to place *Lepralia pallasiana* and its allies side by side with *Schizoporella auriculata* Hass., *S. linearis* Hass., *S. triangula* Hincks, etc., as the group seems very unnatural.

Levinsen's *Cheilopora** contains species some of which have the ovicelligerous zoœcia with a quite differently shaped aperture from that of the ordinary zoœcia, as, for instance, *Lepralia circumcincta* Neviani, a species found fossil, but also living, from Naples, Capri, and Oran (Algiers); whereas *L. longipora* MacG. = *L. prælonga* Hincks, and *L. prælucida* H. have large raised perforated ovicells. This dimorphism occurs in several Lepralidæ, but in Schizoporellidæ I only remember it in *S. subimmersa* MacG. We hardly know yet how far these characters are reliable for generic divisions.

Such forms as *L. adpressa* Busk, *L. hippopus* Sm., *L. rectilineata* H., and the bulk of what we have known as *Lepralia* should remain there until ample living and spirit material of numerous specimens has been examined.

* Haime made a genus *Chilopora* and Michelotti called one *Cheilopora*.

Loc. Philippines, 18 fath. (*Chall.*); Singapore or Philippines (*A. W. W. coll.*); Hong Kong; Lifu (*Ph.*); Manaar (*Th.*); Andamans (*Th.*); Cargados (Ind. Ocean) (*Th.*); (?) Nichol Bay, N. W. Australia (*MacG.*). Wasin, Brit. East Africa, on *Adeonella*, 10 fath., from bottom of s.s. 'Juba,' which always remains in Zanzibar waters (511), collected by Crossland.

Lepralia turrita Smitt. (Pl. LXXIII. fig. 10.)

Lepralia turrita Smitt, Floridan Bryozoa, pt. ii. p. 65, pl. xi. figs. 226–228 (1873); Kirkpatrick, Ann. Mag. Nat. Hist. ser. 6, vol. v. p. 16 (1890); Thornely, "Mar Poly. of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. p. 150 (1912).

The small specimen from Wasin has four long calcareous spinous processes, irregularly placed round the aperture. One or more of these processes may bear an avicularium at one side near the base, as in the spinous process of *H. albirostris* Sm. Besides these avicularia there are on the surface of the zoarium numerous small semicircular avicularia, irregularly scattered. The ovicell is not much raised and has an elongate elliptical opening in the front. A specimen of *Lepralia turrita* in my collection has short blunt processes with similar semicircular avicularia, and the ovicell, which is more raised, has a similar wide opening in the front. Perhaps, on account of the different character of the ovicell, it should at least be made a variety, but until more material is available it is allowed to stand.

The operculum has the sides nearly straight with the proximal edge curved; there are two muscular dots a little distance from the edge and two articular thickenings; the width is about 0·2 mm. This operculum does not correspond with any with which I am acquainted, for though in many respects it is like those of what I should call, in a restricted sense, *Lepralia*, there is no lateral ridge for the muscular attachment, which is not close to the border.

In the British Museum there is a specimen marked *turrita*, which is *Holoporella*, and it seems as if there were more than one with a series of calcareous processes round the oral aperture. What Ridley and what I called *L. turrita* may each have to be placed elsewhere.

Loc. Ascension Island; Florida (*Sm.*); China Seas; Amirante, 29 fath.; Cargados, 30 fath. Wasin, Brit. East Africa, 20 fath. (522), collected by Crossland.

Lepralia wasinensis, sp. n. (Text-fig. 81.)

A small piece with only seven zoœcia was found on re-examining some material, when the paper was almost completed. Only the calcareous part remains, which was probably bilaminate, but this cannot be stated with certainty. The zoœcia have the sides straight and the distal end somewhat rounded, with thick borders to the zoœcia. The oral aperture is subrotund with a wide curve on the distal end surrounded by a thick band. The frontal

surface is closely pitted, and at each side of the oral aperture, somewhat below it, there is a large subtriangular chamber which is probably avicularian. In the band surrounding the oral aperture there is an opening at the proximal end which appears to be avicularian.

Text-fig. 81.

Lepralia wasinensis, sp. n. × 25.

The species seems most nearly related to *Lepralia* (*Mucronella*) *prælucida* Hincks, which has a large avicularium by the side of the oral aperture as seen in my specimens, and as Professor R. Osburn * mentions in his specimens from Labrador.

Loc. Wasin, Brit. East Africa, 20 fath. (520), collected by Crossland.

Lepralia cleidostoma, var. inermis Ortmann.

Lepralia cleidostoma, var. *inermis* Ortmann, "Die Japanische Bry.," Archiv für Naturgesch. vol. i. p. 49 (1890).

Lepralia cleidostoma, var., Hincks, Ann. Mag. Nat. Hist. ser. 5, vol. xiii. p. (41) (1884).

This form has the surface smooth and silvery with frequently an umbo below the aperture and often one on the ovicell. The ovicell is scarcely at all raised and is also smooth and imperforate, and has a small semilunate area. There is sometimes a small knob on each side of the aperture. Both the aperture and the operculum are about the same size and form as that of *L. cleidostoma* Smitt from Madeira †, which also occurs at Florida (*Sm.*), Japan (*Ort.*), and Bermuda (*my coll.*); but *L. inermis* var. differs in having no avicularia, and it is a question whether it is advisable to consider it a species or a variety.

Norman says ‡ that *L. cleidostoma* is the *L. porcellana* Busk, but

* "Bryozoa from Labrador, etc.," Proc. U.S. Nat. Mus. vol. xliii. p. 283, pl. xxxiv. figs. 3, 3 *a*, 3 *c* (1912).

† Waters, "Bryozoa from Madeira," Journ. R. Micr. Soc. 1899, p. 10, pl. iii. fig. 16.

‡ "Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. p. 305, pl. xl. figs. 1, 2 (1909).